THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXV. No. 2124.] LONDON, JANUARY 26, 1904. [56TH YEAR. PRICE 6d.

PARKER & LESTER,

— ESTABLISHED 1830. —

MANUFACTURERS AND CONTRACTORS, **ORMSIDE STREET, LONDON, S.E.**

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

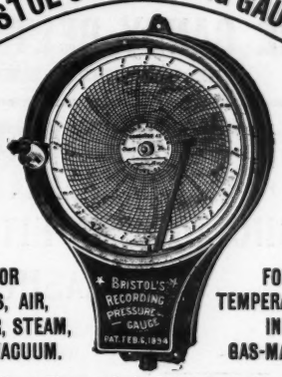
SAFETY GAS-MAIN STOPPER,

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.

GAS-LEAK INDICATOR.

PRICES AND PARTICULARS ON APPLICATION.

BRISTOL'S RECORDING GAUGES

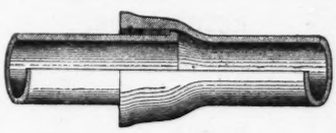


FOR GAS, AIR, WATER, STEAM, OR VACUUM.

FOR TEMPERATURE IN GAS-MAINS.

Many Thousands in Daily Operation.

J. W. & C. J. PHILLIPS,
23, COLLEGE HILL,
LONDON, E.C.



Diameters 1½ in. to 78 in.

VERTICALLY CAST IRON PIPES.

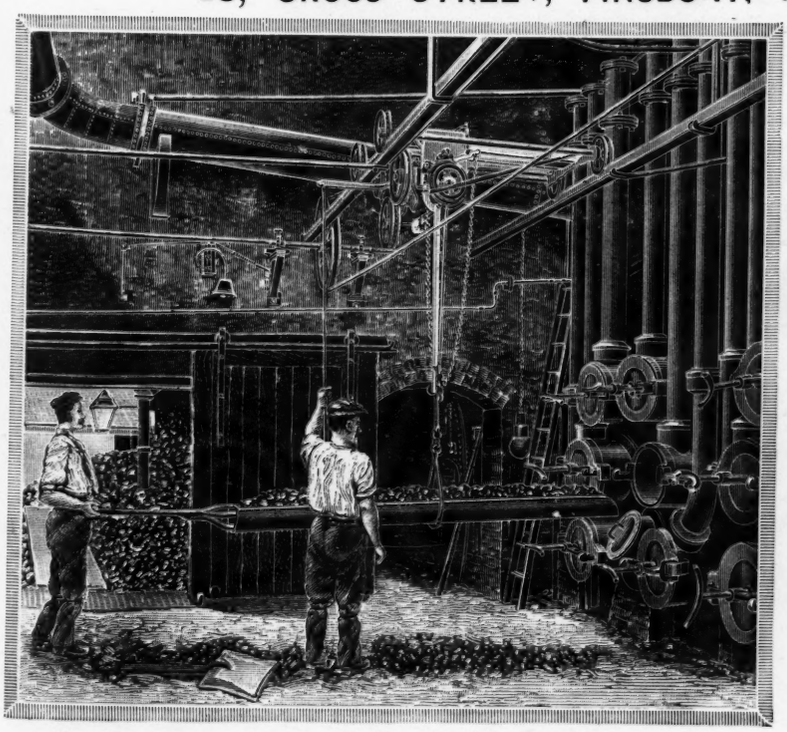
The only Foundry in Europe casting Pipes under Clarifying Process.

A. G. CLOAKE, 54, Holborn Viaduct, London, E.C.

Telegrams: "AMOUR, LONDON." Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

BIGGS, WALL, & CO.,

13, CROSS STREET, FINSBURY, LONDON, E.C.



Telegrams: "RAGOUT, LONDON."
Telephone: 273 CENTRAL.

"RAPID"
MANUAL & POWER
CHARGING APPARATUS,

FOR GAS-WORKS OF ALL SIZES.

Repeat Orders
YEOVIL, NEWPORT, SOUTHBANK, WORTHING, ALDERSHOT.

Machines can be seen working at any of the following Works:—

ALDERSHOT	WREXHAM
WORTHING	SWINDON
YEOVIL	EPSOM
TRURO	SHETTLESTON
NORMANTON	DUBLIN
OTLEY	G. S. & W. Rly. Works
GOOLE	NEWPORT, MON.

GANDY'S BELTING

Holds the World's Record! 41 Prize Awards!

IN A WATER-GAS PLANT, an important item is the Belt for driving the Blower. Ours are specially constructed **Endless Belts,** and have acquired a reputation for this special Work.

CONVEYOR BELTING—A SPECIALITY.

THE GANDY BELT MANUFACTURING COMPANY, LTD.,

HEAD OFFICES AND WORKS—**SEACOMBE, LIVERPOOL.**

This Trade Mark may be seen stencilled on every genuine "Gandy" Belt.

Telegrams: "COCKEYS, FROME." **EDWARD COCKEY & SONS, LTD.,** *Telegrams:* "DAMPER, LONDON."

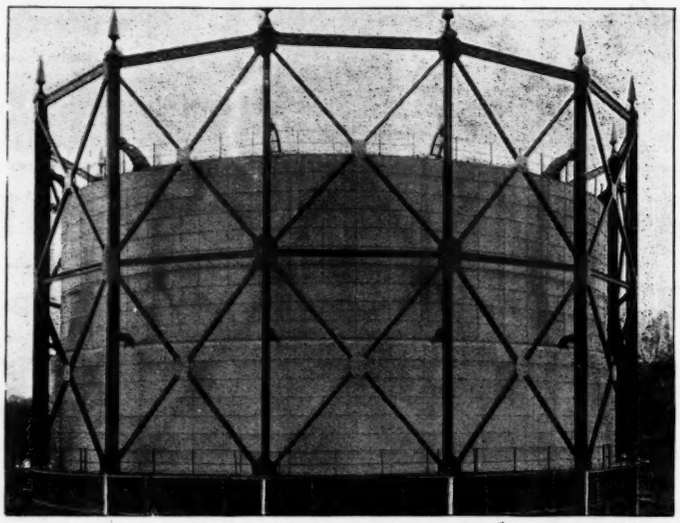
GASHOLDERS IN EITHER STEEL OR WROUGHT IRON.

GASHOLDER TANKS IN STEEL, WROUGHT OR CAST IRON.

CAST-IRON COLUMNS.

STEEL or WROUGHT IRON STANDARDS. *(Any Section.)*

INLET and OUTLET PIPES in either CAST or WROUGHT IRON, or STEEL.

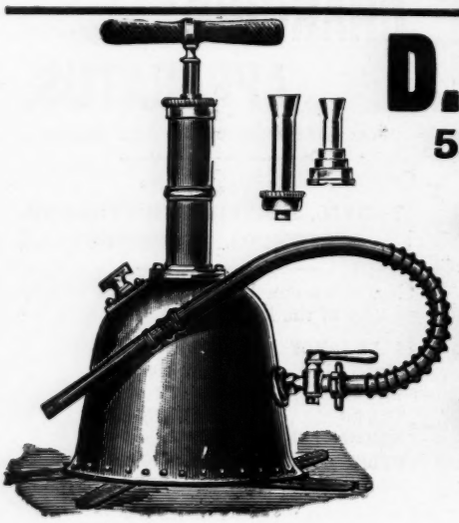


HYDRAULIC MAINS.
FOUL MAINS.
CONDENSERS.
RETORT-LIDS.
PURIFIERS.
HYDRAULIC LIFTS.
ROOFS.
BOILERS in either WROUGHT IRON or STEEL.

LAMP COLUMNS, MAIN PIPES, and IRREGULARS always in Stock

THE IRON-WORKS, FROME, SOMERSET.

London Office: 181, QUEEN VICTORIA STREET, E.C. *BALE & HARDY, Agents.*



D. HULETT & CO., LTD.

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

PRICE LISTS ON APPLICATION.

THE BARROWFIELD IRON-WORKS, LIMITED,

GAS ENGINEERS & CONTRACTORS,

Telegrams: "GASOMETER GLASGOW."

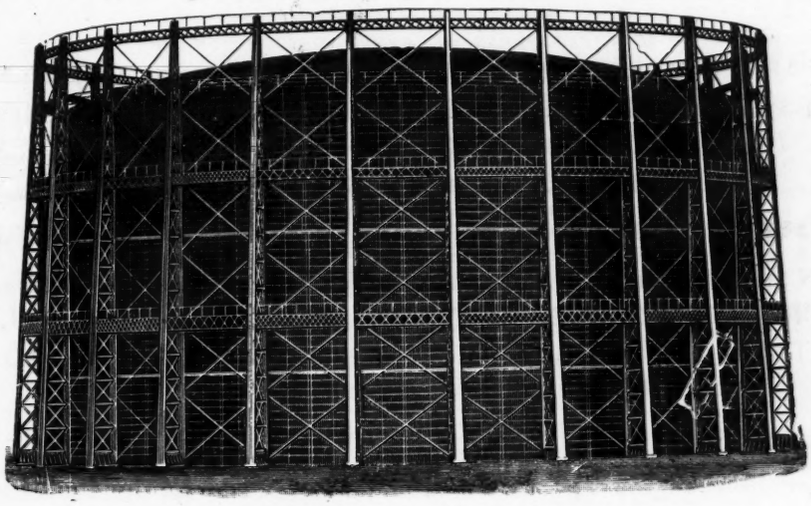
GLASGOW.

OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.



GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS, AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.

THREE-LIFT GASHOLDER. Capacity, SIX MILLION cubic feet.
240 feet Diameter by 45 feet Deep each Lift. Erected at Glasgow, 1893.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

GEORGE ORME & CO. (Branch of Meters Ltd.)

ATLAS METER WORKS,

Tel. Address: "ORME OLDHAM."
Telephone No. 93 Oldham.

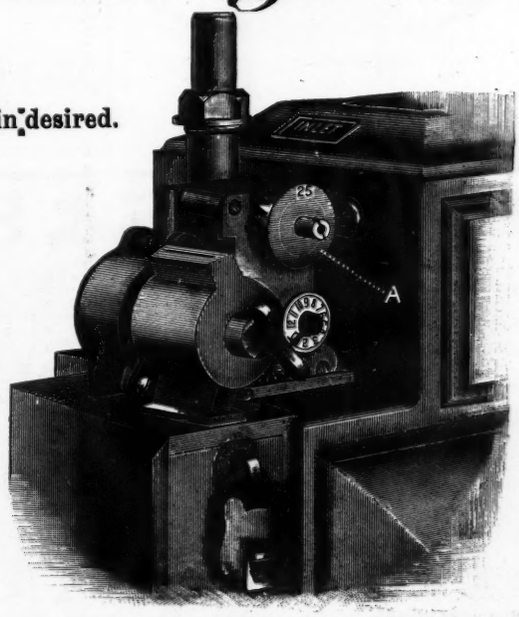
PARK STREET, OLDHAM.

"NEW CENTURY" PATTERN

Patent Coin *Prepayment Gas-Meters*

Fitted with Detachable Attachments.

Arranged for 1d., 1s., or any other Coin desired.



Change of Price effected by simply removing Crown Wheel "A" and replacing same with another Wheel.

ANY FURTHER PARTICULARS WILL BE SUPPLIED UPON APPLICATION.

NEWTON, CHAMBERS, & CO.,

LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

Established 1790

LONDON OFFICE: 19, Great George Street, WESTMINSTER.

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

MANUFACTURERS OF EVERY DESCRIPTION OF

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.
RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS AND ELEVATORS.
CONDENSERS, SCRUBBERS, AND WASHERS.

PURIFIERS with Planed Joints a Speciality.

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS AND SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS.
STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.
GASHOLDERS CAST-IRON OR STEEL TANKS.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its unrivalled excellence.

BARRY, HENRY, & CO.,

— LIMITED. —

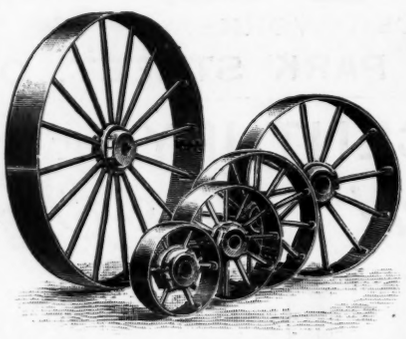
Specialities:

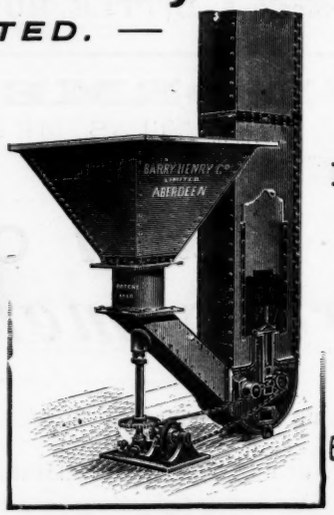
TRANSMISSION OF POWER.

Rope & Belt Pulleys,
Spur & Bevel Wheels,
Shafting & Couplings,
Pedestals, & Fixings.

WORKS:

ABERDEEN, SCOTLAND.





Specialities:

TRANSMISSION OF MATERIALS.

Conveyors
Elevators,
Grinding Machinery,
Motors.

AND

64, MARK LANE, LONDON, E.C.

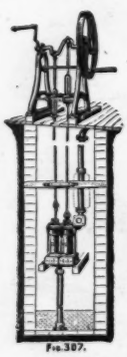
JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

London Address:
Salisbury House, London Wall, London, E.C.

PLEASE APPLY FOR CATALOGUE No. 8.

Telegrams:
"EVANS, WOLVERHAMPTON."
National Telephone No. 7089.

TRADE MARK.
FIRST AWARDS EVERYWHERE.



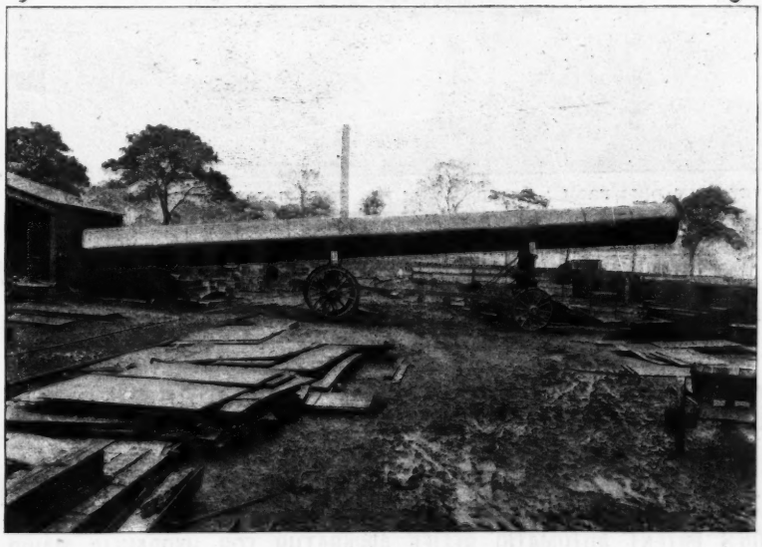
See next Week's Advertisement for Steam-Pumps, Tar and Liquor Pumps, &c.

THE GEORGE FISCHER STEEL & IRON WORKS, LTD.,
20, High Holborn, London, W.C.
MAKERS OF THE
Telegrams: "Connexions London."
G.F. HIGH-GRADE MALLEABLE IRON TUBE FITTINGS
Of new Designs and Standard Patterns in over 3000 varieties of sizes.
Northern Agency—
77, Oswald Street, Glasgow.
Works and Offices—
Schaffhausen, Switzerland.

GAS
THE WINSTANLEY SPECIALTY COY.
ENGINEERS

GAS ENGINEERS.
CONTRACTORS FOR, AND ERECTORS OF, ALL GAS-WORKS PLANT.
REGENERATORS, GENERATORS, AND DIRECT-FIRED RETORTS.
RESULTS GUARANTEED.
COMPLETE INSTALLATIONS OF HORIZONTAL AND INCLINED RETORTS.
ADDRESS—
NEWTON CHAMBERS, CANNON ST., BIRMINGHAM.

ELEVATING & CONVEYING PLANTS
DRAKES LIMITED
Telegrams: "Drakeson, Halifax." *Telephone: "No. 43 Halifax."*



LONDON 180 Queen Victoria St. E.C. HALIFAX NEW YORK 395 Broadway.

ALBION IRON WORKS,
MILES PLATTING,

MANCHESTER.
TELEGRAMS—
"STOKER, MANCHESTER."

WEST'S GAS IMPROVEMENT CO., LD.

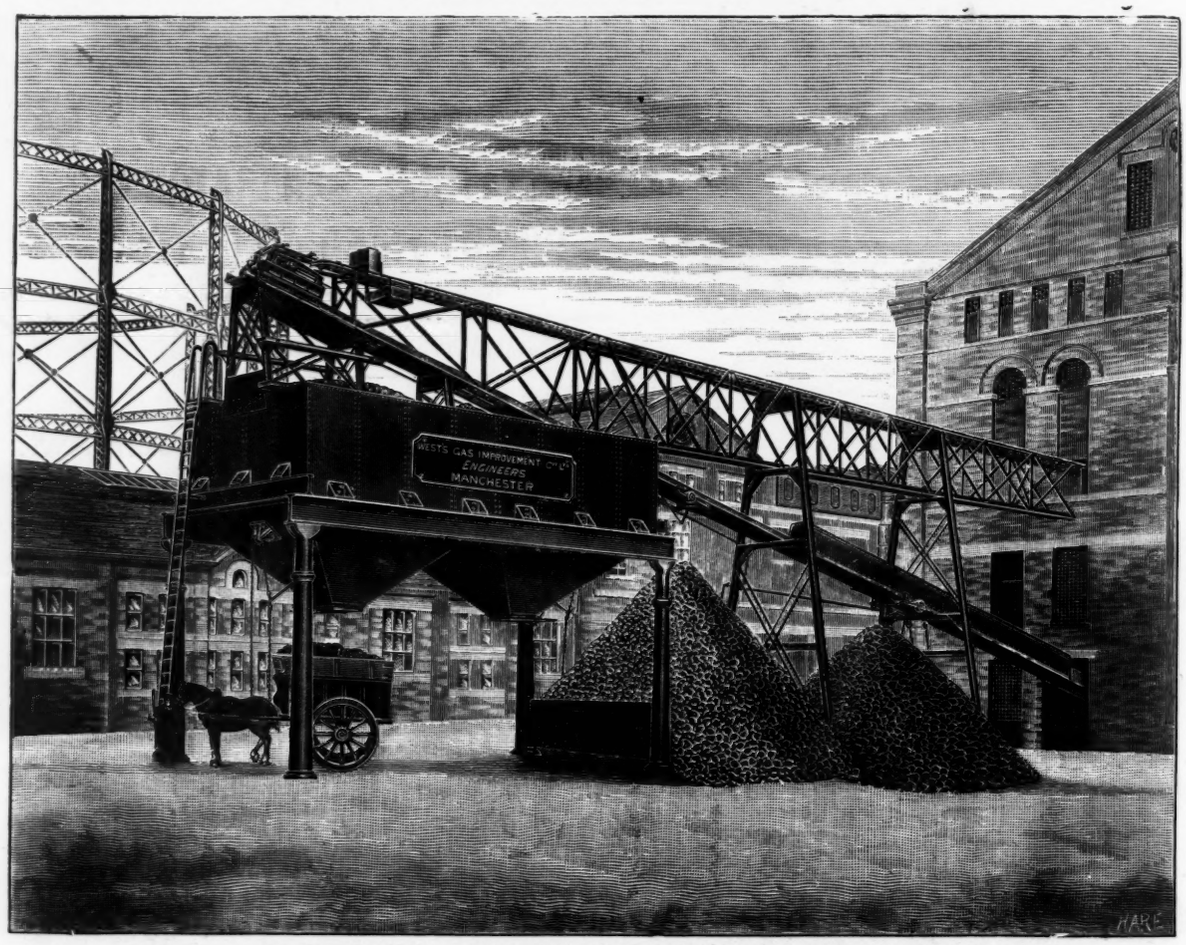
Gas and General Engineers.

CONTRACTORS FOR

COMPLETE RETORT-HOUSE PLANT

. . . EITHER ON . . .

THE HORIZONTAL OR INCLINED SYSTEMS.



WEST'S CONVEYOR LEADING FROM A RETORT-HOUSE FOR STORING COKE IN HOPPERS AND COKE YARD.

SECTION OF

WEST'S IMPROVED PATENT HOT-COKE CONVEYOR,

With Special Chain constructed with a minimum number of parts, and having Large Joint Pins with ample Bearing Surfaces.

WEST'S STOKING MACHINERY— COMPRESSED AIR DRIVEN AND MANUAL SYSTEMS

COAL BREAKING, ELEVATING, & STORING PLANTS.

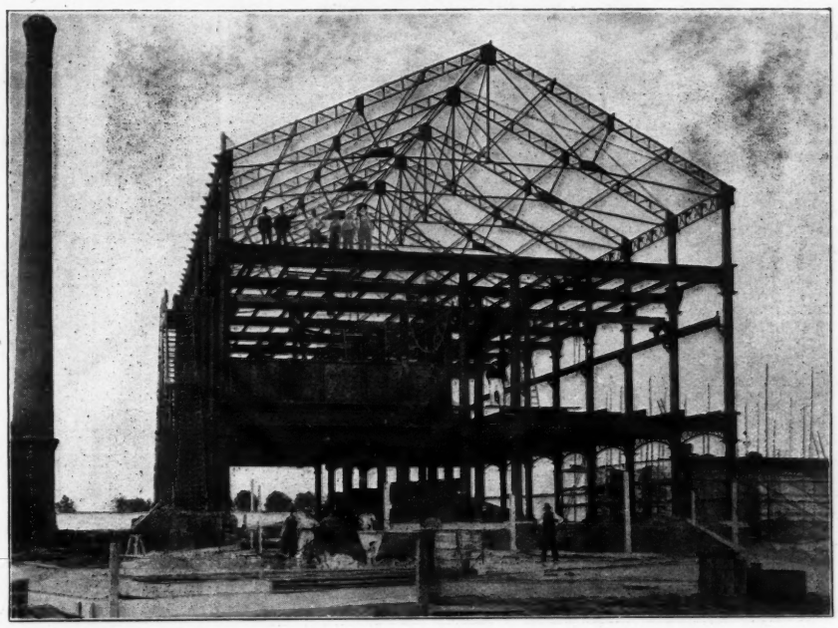
BELTON'S PATENT AUTOMATIC RELIEF APPARATUS FOR HYDRAULIC MAINS.

Manufacturers for America : Riter-Conley Manufacturing Company, Pittsburg.

THE WHESSOE FOUNDRY CO., LTD.

Works: DARLINGTON.

MAKERS OF EVERY DESCRIPTION OF GAS PLANT.



GASHOLDERS AND DRY-SEAL PURIFIERS A SPECIALITY.

PHOTO. OF STAGE-FLOOR PURIFIER-HOUSE TAKEN DURING ERECTION FOR THE UNION DES GAZ AT THEIR WORKS NANTERRE, PARIS

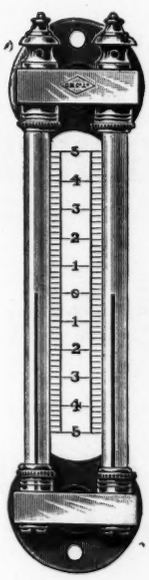
London Office: 106, CANNON STREET, E.C.

THE GAS-METER CO., LTD.,

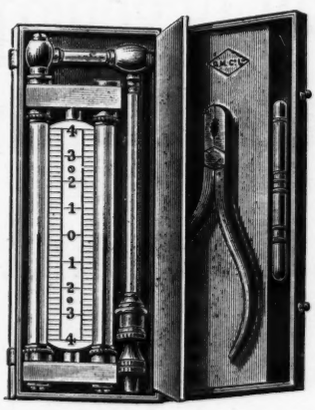
Manufacturers of

Wet & Dry Gas-Meters, Automatic Meters, Station Meters, Governors, Main Taps, Lamp Taps.

GAUGES, &c.

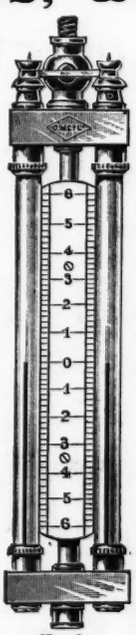


No. 1.

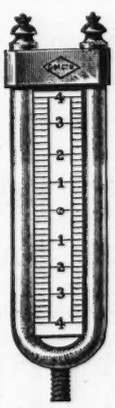


Inspector's Pocket Gauge.

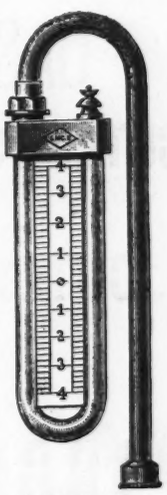
Telephone Nos:
142 Dalston (Nat.), 340 Oldham (Nat.),
1995 Dublin (Nat.), 2918 Manchester (Nat.).



No. 3.



No. 4.



No. 5.

Telegraphic Addresses:
"METER LONDON," "METER OLDHAM,"
"METER DUBLIN," "METER MANCHESTER"

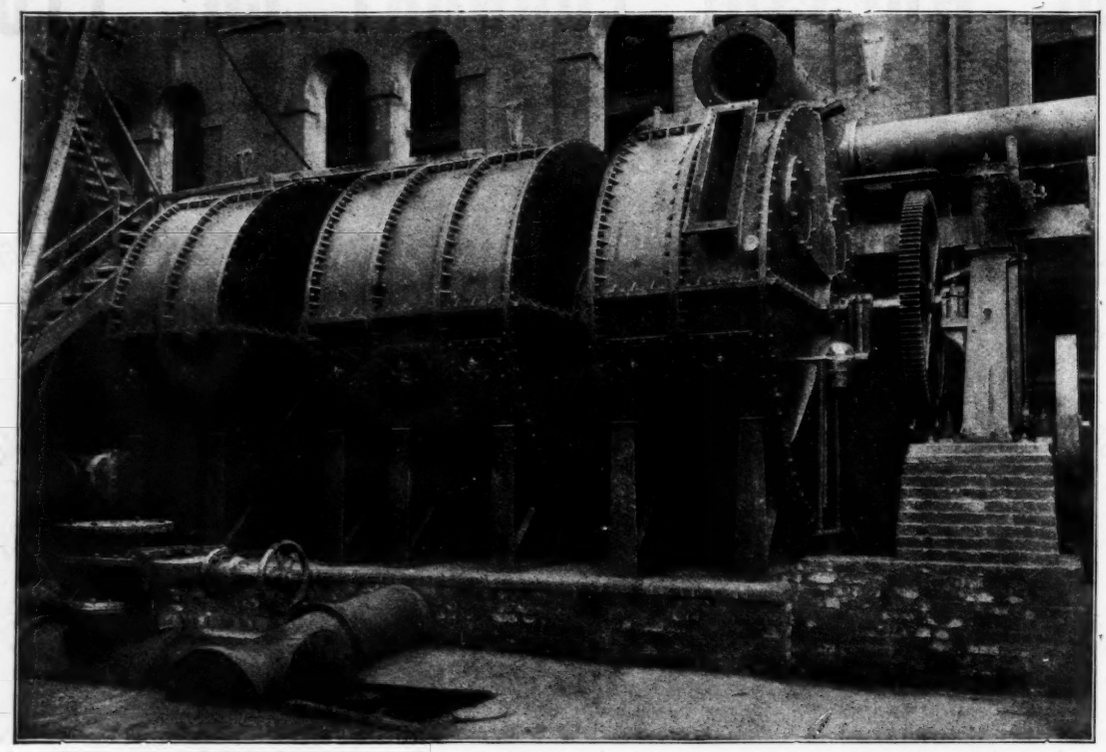
For Prices and Particulars apply:

Works: 238, Kingsland Road, LONDON; Union Street, OLDHAM; Hanover Street, DUBLIN.

KIRKHAM, HULETT & CHANDLER, LTD.

PALACE CHAMBERS, BRIDGE ST., WESTMINSTER, S.W.

Extracts ALL the Ammonia and large proportion of CO_2 and H_2S.



Maximum Washing Surface. Easy access to Bearings and Interior.

IMPROVED PATENT "STANDARD" WASHER-SCRUBBER.

Telegraphic Address: "WASHER, LONDON."

Telephone No. 127 VICTORIA.

SAML. CUTLER & SONS,

MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

Gasworks Plant of every kind.

SPRING IS THE TIME FOR BARGAINS.

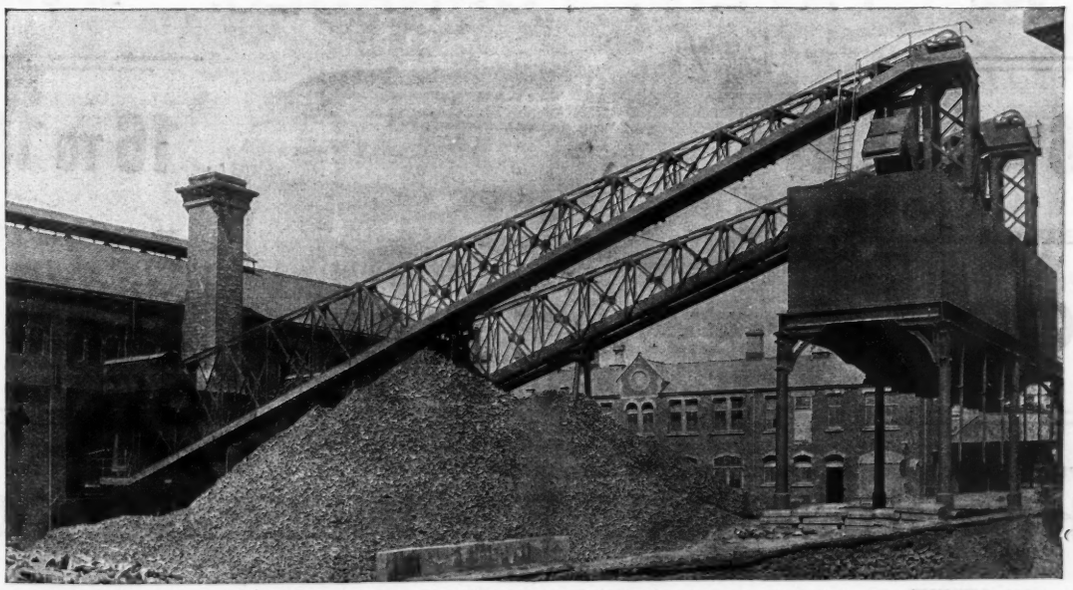
"ACME"
Gas-Fires
are a bargain at any time.

Arden Hill & Co.,
"Acme" Works,
Birmingham.

THE

DE BROUWER PATENT HOT COKE CONVEYOR

GUARANTEED BY SOLE MAKERS.



W. J. JENKINS & Co., LIMITED, RETFORD.

HENRY BALFOUR & CO.

LIMITED,

LEVEN, FIFESHIRE.

Contractors for the Supply and Erection of all Classes of

Gas-Works Plant.

THE "ANNULAR" BRUSH WASHER-SCRUBBER

(CREEKE'S PATENT).

Made with Cast-Iron or Mild Steel Cylinders.

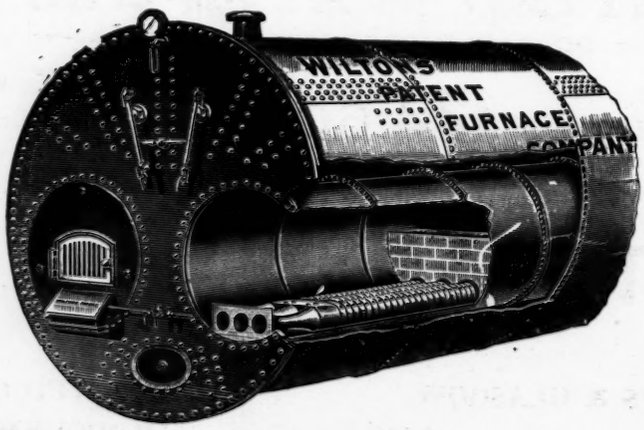
PRICES AND PARTICULARS ON APPLICATION.

London Representative: MR. HENRY PUPLETT, 47, VICTORIA STREET, S.W.

WHEN ORDERING YOUR NEW BOILERS SPECIFY

7000 IN USE. **WILTON'S PATENT FURNACES.** **7000 IN USE.**

16 TO 18 per cent. CO_2



16 TO 18 per cent. CO_2

FULL PARTICULARS AND PRICES ON APPLICATION TO

THE CHEMICAL ENGINEERING CO.

AND

WILTON'S PATENT FURNACE CO.,

79, MARK LANE, E.C.

Telephone: No. 2669 AVENUE.
Telegrams: "EVAPORATOR, LONDON."

CROWN WORKS, ABBEY LANE, STRATFORD, E.

CONTENTS.

EDITORIAL NOTES.

GAS, &c.—
Inventors and Invention 197
The Comparative Cost of Gas and Electric Light 197
The Expansion of the Lighting Trades—Stagnation in "Power" Enterprises . 198
The Depreciated Value of High-Class Investments 199
Electricity Nearly Half the Price of Gas—Destruction of Meters by Fire—And the Responsibility—The Growth of a Corporation Debt 199

WATER AFFAIRS—
Progress of the Metropolitan Water Arbitration 200
Water Questions in the Court of Appeal . 201

ESSAYS AND REVIEWS.

Gas and Water Stock Market 202
Electric Lighting Memoranda 202
The Trend of Gas Invention 203
Recent Coal and Petroleum Statistics. . . 204
Water Bills for 1904 205

TECHNICAL RECORD.

Mr. Fletcher Moulton on Inventors and Invention 206
The New Gasholder at Guernsey 208
The Incandescent Gas-Mantle 208
New Forms of "Pond" Lamps 208
A Mantle Factory in Berlin 209
Cause of Emission of Light by Flame. . . 212
Calorimetric Tests of Coals 213
Flame Temperature and its Measurement . 215

CORRESPONDENCE.

The Improved Gas-Bracket 218
The Vertical Retort at Exeter 218

REGISTER OF PATENTS.

Gas Burners and Mantles—Helps, G.. . . 215
Internal Combustion Engines — Crossley, W. J., and Webb, W. Le P. 215
Retort-Charging Apparatus—Bronder, G. A. 216
Gas-Purifiers—Dempster and Sons, R., and Broadhead, J. W. 217
Station Gas Meters—Boult, A. J. (La Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz) 217
Incandescent Gas-Burners—Keith, J. & G. . 218
Patent Notices 218

LEGAL INTELLIGENCE.

High Court of Justice—Chancery Division—Attorney-General and Others *v.* Ashton Gas Company—Question as to the Payment of Income-Tax 218
Wrexham County Court—Rhos Gas Company *v.* British Electric Traction Company, Limited, and the Wrexham and District Tramways Company, Limited 219
Free Water for Fire Extinction. 219
A Caretaker's Extravagant Use of Gas . . 219
A Water Diviner at Fault 219
Embezzlement by a Gas Manager 220
The Dangers of Water-Valve Boxes . . . 220
Dishonest Gas-Works Employees 220

MISCELLANEOUS NEWS.

Metropolitan Water Arbitration 220
Incandescent Gas Lighting in Paris . . . 223
Facts for Elland Ratepayers and Consumers. 223
Proposed Removal of the Ilfracombe Gas-Works. 223
The Public Lighting of Windsor 223
Gas Complaints at Burslem—More Purifying Power Needed 223
Slot Consumers and Warrington Gas Profits . 224
The Bristol Gas Poisoning Case 224
Glastonbury Corporation Gas Undertaking—Local Government Board Inquiry . . . 224

MISCELLANEOUS NEWS (*continued*)—
The Marylebone Electric Lighting Muddle . 224
Metropolitan Water Board—Cost of the Arbitration. 225
Manchester Corporation Water Supply—Statistics of Supply and Rainfall . . . 225
Bursting of a Reservoir at Bloemfontein . . 225
Proposed New Water Regulations 226
Gas Supply in Philadelphia 226
Notes from Scotland 227
Current Sales of Gas Products 228
Coal Trade Reports 229
Stock and Share List 233

PARAGRAPHS.

Personal and Obituary—Transactions of the Institution of Gas Engineers 201
The London County Council and Gas and Meter Testing—The Metric System. . . 211
Dividend of the Gaslight and Coke Company 215
New Water Scheme for Leeswood 218
Weavers Overcome by Gas 220
Suggested Water Purchase at Gosport . . . 222
Lighting of Birkdale and Ainsdale 223
Glyncorrwg Gas Supply 225
Opposition to the Crystal Palace Gas Company's Bill 229
Reduction in Price—Rejection of the Basingstoke Corporation Bill—Proposed Amalgamation of Southport and Birkdale—Proposed New Reservoir for Northallerton—Opening Roads and Alterations to Gas-Pipes—Serious Gas Explosion at Scarborough—Alderman Gibson on the Price of Gas in Manchester 230
Chard Water Supply—Unsatisfactory Electric Lighting at York—Price of Gas in Southampton Out-Districts—Incandescent Gas Lighting in Marylebone—Alderman Lowden on the Gas Policy at Leeds—Sales of Shares—New Joint-Stock Companies . 231
Electric Light at Hartlepool—Pudsey Gas Company—Coventry Water Supply—Carnarvon and the Electric Light 232

Messrs. HUMPHREYS & GLASGOW

AND

THE UNITED GAS IMPROVEMENT CO., U.S.A.

CARBURETTED WATER-GAS PLANT

— *DOUBLE SUPERHEATER SYSTEM.* —

H. & G., LONDON **144,600,000** Cu. Ft. Daily

U. G. I. CO., U.S.A. **376,300,000** Cu. Ft. Daily

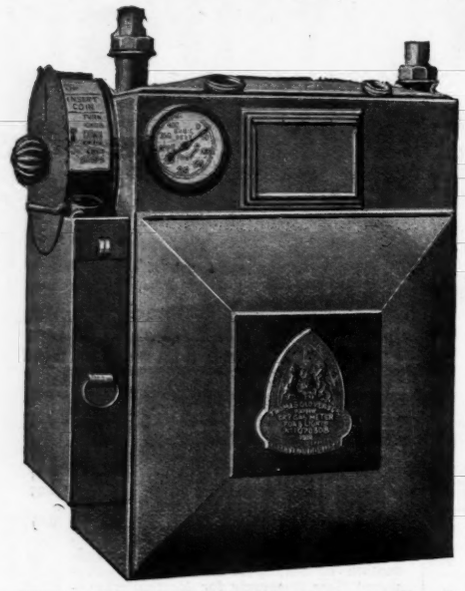
TOTAL 520,900,000 Cu. Ft. Daily

Messrs. HUMPHREYS & GLASGOW,
38, Victoria Street, London, S.W.
31, Nassau Street, New York.

THE UNITED GAS IMPROVEMENT COMPANY,
Philadelphia.

Telegrams: {"EPISTOLARY, LONDON."
"HUMGLAS, NEW YORK."

THOMAS GLOVER & CO.'S



PATENT NEW IMPROVED PREPAYMENT METER

For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." **Telephone No. 6159 Bank.**

THOMAS GLOVER & CO., LTD.,

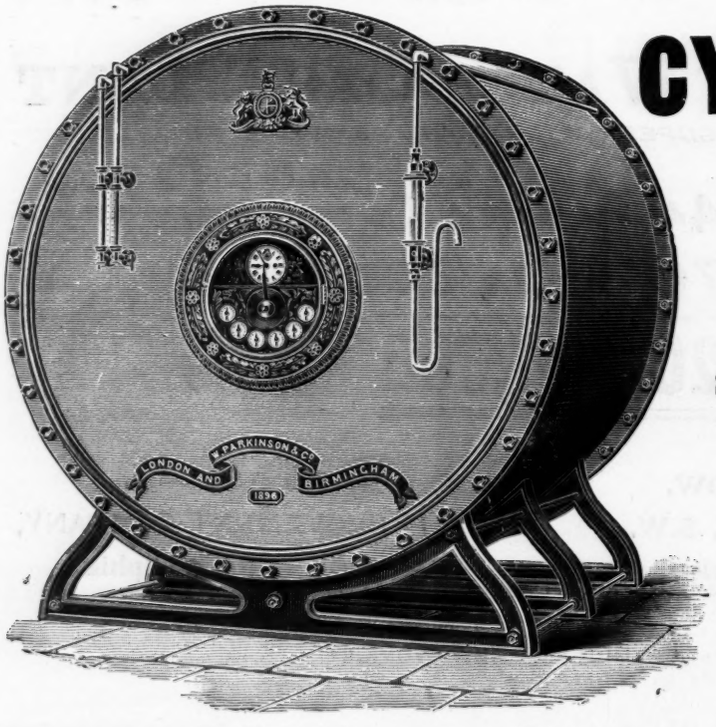
GAS-METER MANUFACTURERS,

LATE OF CLERKENWELL, NOW 49, QUEEN VICTORIA STREET.

Telegraphic Address: "GOTHIC, LONDON." **Telephone No. 6159 Bank.**

BRISTOL:	BIRMINGHAM:	MANCHESTER:	GLASGOW:	BELFAST:	MELBOURNE:
28, BATH STREET.	57 & 58, BROAD STREET.	132 & 134, CORN EXCHANGE BUILDINGS.	26, WEST NILE STREET.	8, EXCHANGE PLACE, DONEGALL STREET.	23, WRIGHT'S LANE, LONSDALE STREET.
Telegraphic Address: "*GOTHIC.*"	*Telegraphic Address:* "*GOTHIC*"	*Telegraphic Address:* "*GOTHIC.*"	*Telegraphic Address:* "*GASMAIN.*"	*Telegraphic Address:* "*GOTHIC.*"	
Telephone No. 1005.		**Telephone No. 3898.**	**Telephone No. 6107 Royal.**		**Telephone No. 3716.**

PARKINSON'S



CYLINDRICAL METERS

Some have been in constant use for over **60** Years.

PARKINSON AND W. & B. COWAN, LTD.
(*Parkinson Branch*),

COTTAGE LANE, CITY ROAD, LONDON.

BELL BARN ROAD, BIRMINGHAM.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXXV., No. 2124.—TUESDAY, JANUARY 26, 1904.

EDITORIAL NOTES—GAS, &c.

Inventors and Invention.

BRILLIANT indeed was the address with which Mr. Fletcher Moulton, K.C., M.P., inaugurated last Friday evening his presidency of the Junior Institution of Engineers—an office which the highest in the land identified professionally, or intimately in other walks as the present occupant, count it an honour to tenant. "Whatsoever thy hand findeth to do, "do it with thy might," is the unexpressed, but visible motto throughout this comprehensive address—which is saying, in other words, that into the composition, though for the ears of budding engineers and not their more exalted seniors, Mr. Moulton put of the best that his matured and vast experience as an eminent legal practitioner, who has been an observant and interested spectator of the struggles and triumphs of engineering and mechanical science, has brought to him. He headed his address "Invention"—a term for which, he confesses, no adequate definition has yet been found, nor an inflexible definition that is of the slightest assistance to anyone in a legal quandary in regard to invention. Something, however, of the vastness of what is comprehended in the word may be gathered from the address; but to bring all that therein is written on the subject within any pithy definition would defy the most imaginative faculty and ability. However, while the gifted President failed in finding a concise descriptive phrase for the term invention, he gave his audience something which will be of far more value to them as a guide, and not to them only but (there can be no better wish) to all inventors present and future. It would be a pity indeed if such a splendid and eloquent exposition of things that every inventor or inventor in embryo should know were packed away and lost to mankind. We believe that opportunity has permitted us to be the first to publish anything like an extended account of the address; and, in virtue of that, the hope may be expressed that our technical contemporaries will see their way to give to their readers—among whom, as in our own sphere, are numbered many who apply themselves to invention—the benefit of the wisdom that fell from Mr. Moulton, than whom cannot be found a better master of this special subject.

We cannot do more here than run lightly over a few of the learned President's many points. "One of the com-"monest and most fatal errors committed by would-be "inventors is to view invention as if it had no past" may be taken as the text of the first part of his dissertation. In plain language and by illustration, he impressed upon those gathered before him that the elements of mechanism —approved devices for effecting definite mechanical results —were themselves originally the results of invention; and each element represents a past achievement and a present and future power. These elements are of the equipment of the inventor. They include, as Mr. Moulton points out, many great conceptions which ever since their introduction have been the mainstays of the inventive world, and have exercised a vast influence upon human progress. To study them and their developments, to understand them, and to fully recognize their help and worth, is the preliminary task of the inventor. Then comes the next essential, and that is the necessity of realizing that a new invention must have a higher efficiency in some respect than anything in the same line that has gone before. Step by step, the President carries us onwards in the progress of the inventor and his invention. There is the determination of the cycle of operations; and then the designing of the new machine. Even at that point, the invention is only fundamental; and upon it devolves subsidiary invention—either modification or addition—so as to attain higher results. A common fault of inventors is to leave, through want of patience, their work in an incomplete and useless state. In his secret heart, Mr. Moulton regards them as almost an "unmitigated "nuisance"—seeing that they detract from the merit of those who, by greater perseverance, succeed where they have failed; and their only glory is such as is obtained by their unfinished work being paraded in the Law Courts as anticipations, with the venal object of diverting from the proper channel the reward of success.

Quite the first half of the address was advisory; and proper appreciation of all that is contained in it will help the would-be inventor to pass in safety round the many pitfalls that lay in his path. But when the new machine or a modification of an old machine is perfected, then the question arises whether it is good matter for letters patent. Here the difficulties of the patent lawyer come in; and one cannot, on hearing or reading what Mr. Fletcher Moulton has to say in this regard, help feeling some sympathy for him and others in this special line of practice, though that sympathy may be lightly esteemed in view of the fact that it is the frequently recurring difficult problems which he and his like have to solve that account in large part for their flourishing existence in the upper legal regions. However, it is interesting to have the opinion of such a luminary as Mr. Moulton that when an invention (rightly or improperly so named) is submitted to the judgment of the Courts, they—in this, as in many other questions—lean to the practical rather than to the dogmatic. It is becoming a feature of too common occurrence for imitators of successful invention to rely for safety on "anticipations" supplied by unsuccessful invention. But, being unsuccessful, are they in truth "an-"ticipations" of the successful? If such imitators would only take heed of Mr. Moulton's words on this point, much litigation and vexation would be prevented, and money and valuable time saved.

> I am happy to say [said Mr. Moulton] that, when an inventor is modest in his claims, and seeks only to protect that which he has in fact made practically useful, the tendency of the jurisprudence of our country is to pay little heed to antecedent incomplete or useless attempts. I have long contended, and I think it is now settled law in our Courts, that an invention is not made until it has been developed so far that the normal result of its working is success. Uncertainty in result beyond this point means practical uselessness, and as it in fact leaves the field still unoccupied for future inventors, so it should do in law; and their fame and their reward should not be lessened by the useless half successes that have preceded them.

We have attempted here to bring into prominence some, though by no means all, of the features of this characteristically thoughtful and superb address, which, as has been shown, is not limited in its application to any one particular branch of industry. Appreciation of the truths and advice, combined with the encouragement, contained in it will contribute to the consummation of Mr. Moulton's wish that those who heard it (and, we would add, those who read it) may be sharers in the triumphs which the future still holds in reserve for invention.

Comparative Cost of Gas and Electric Light.

THE everlasting question of the comparative cost to the consumer of gas and electricity for lighting, on the basis of light for light, seems to be beyond the power of human wit to answer so as to command general assent. Just as the eternal truths of the multiplication table and the rules of arithmetic have to be taught and re-taught in schools, so, wherever the electric light goes, this tremendous problem of its cost, as compared with gaslight as locally supplied, has to be solved anew. We are almost inclined to apologize for mentioning the subject here, at this time of day; but, really, when one notices how persistently the electric lighting interest in fresh localities misrepresents the matter, and how continually the harassed provincial gas manager is challenged to meet assertions in this regard which are the hoariest of untruths, the temptation to go over the old ground once a quarter or thereabouts is almost irresistible. We propose, at any rate, to attempt the demonstration once more; being moved thereto by the fact that Mr. F. W. Goodenough has just been impelled to correct a misleading statement of the "Ironmonger" on this point.

In the course of the usual replying to correspondents of which the publication mentioned always makes a great

show, the assertion was put forward that electricity at 4d. per unit is the equivalent of gas at 3s. 6d. per 1000 cubic feet. Mr. Goodenough correctly points out that this statement cannot be true, inasmuch as the lighting efficiency of self-intensifying incandescent lamps (recommended by the "Ironmonger") is at least 25 candles per cubic feet of gas consumed. As the inquiry related to the production of a total lighting effect of 3750-candle power, this means, on the basis taken, an hourly consumption of 150 cubic foot of gas, costing, at the price named, 6·3d. Adding for the bye-pass consumption during non-lighting hours 2d., and for burner maintenance 1·2d., this makes the total cost of the light 9½d. per hour. Assuming that the alternative to this is the employment of 4-watt per candle incandescent electric lamps, the consumption of electrical energy to produce the same amount of light would be 15 units, which must be priced at less than two-thirds of a penny per unit to keep the cost for current alone down to that of the gas—leaving nothing for renewals of lamps and meter-rent. With Nernst lamps, supposed to work at twice the efficiency of the incandescent carbon lamp, the electricity might cost twice as much, or 1¼d. per unit, which again would be without provision for renewals, understood to be heavy in the case of these lamps. If the highest degree of economy of gas with high-power lighting is desired, Mr. Goodenough recommends the system perfected for the Government by Mr. Onslow, of the Woolwich Arsenal, which has been described in the "JOURNAL." And, of course, there are others with which an ironmonger who knows his business, and does not wish to be outclassed by a gas company or a municipal gas committee, might be supposed to be familiar.

Rather remarkably, the ironmongers of England are now stirring in their sleep, before their interest in questions of gas and electricity consumption for lighting has quite departed. They have succeeded by strenuous effort in organizing and holding an examination in Birmingham, under the auspices of the Ironmongers' Federated Association, for assistants, with the laudable object of raising the standard of technical accomplishment of followers of the trade; and one of the questions put into the paper examination is reported to have "dealt with gas-fittings." Seeing that these aspiring hardwaremen probably propose to continue to deal in gas-fittings, it was quite right and proper to ascertain what they knew about these goods. It does not appear that a high standard of acquirement in this regard is considered necessary for those who undertake to reply to the subscribers of the "Ironmonger" who, as in the current issue, want to know how electric light at 6d. per unit compares, in point of cost to the user, with gas at 3s. 10d. per 1000 cubic feet. A considerable amount of parade is made in introducing the official answer to this simple question, apparently with a view to avoid a definite statement, which could but be extremely favourable to gas. In addition, it is remarked, to the prejudice of gas, that it "varies very much in quality, so much "so in some places that people cannot get nearly so good "a light as they used to get with ordinary burners, and "are forced to use mantles. With electricity, on the other "hand, provided the pressure keeps constant, 'quality' has "no meaning." Of course, electrical pressure never varies, even during fogs; and electric incandescent lamps always yield their nominal efficiency of 4 watts per candle!

Yet this doubter of the uniform excellence of modern gas proceeds to admit that "a gas-jet gives 3 candles per cubic "foot of gas burnt per hour"—not a bad performance, seeing that the "London" argand test-burner would not do much better with the very best Metropolitan brand of the article. It is hardly necessary to remark, that the comparison of gas with electric light is thereupon made as between this so-called "jet" burner, with an efficiency of 3 candles per cubic foot, and incandescent electric lamps with a full duty of 4 watts per candle, and Nernst lamps of twice this nominal efficiency. Even so, inasmuch as 1000 cubic feet of gas are taken at the price of 3s. 10d., and yield 3000 candle-hours of light for the money, the equivalent quantity of electricity, at 4 watts per candle, is 12 units, which must not cost more than 3·8d. per unit to stand on equal terms with this rather expensive gas. But why a consumer should not be as free to use incandescent gas as incandescent electricity is not apparent. If he may but exercise this liberty, then instead of a lighting efficiency of only 3 candles per cubic foot, his gas will give him at least 20 candles per cubic foot, without going into high-power lighting. The difference is practically as 7 : 1. Consequently, on the "Ironmonger's" own figures, in order that electric light may equal in cost gas of a very ordinary quality at the high price of 3s. 10d. per 1000 cubic feet, it must be supplied at about ½d. per unit for use with ordinary incandescent lamps. Perhaps, however, the way in which most consumers would find the comparison work out in their bills is on the basis of the consumption per point, not strictly on that of illuminating power. This would allow for some points using flat-flames and others incandescent gas-burners of the same consumption—say, 3½ cubic feet per hour. The electric light might similarly be realized by a mixture of 16-candle incandescent carbon, and Nernst lamps taking the same current of 64 watts, while yielding about double the light. Let us price the gas at 3s. per 1000 cubic feet, which means the cost of supplying 285 of these points for an hour. The same number of electric light points would absorb in the time $285 \times 64 = 18{,}240$ watts, or 18¼ units of current, which would have to be purchased at less than 2d. per unit to do similar service at a like cost—neglecting any differences of lamp renewals and meter-rent, which would not be on the side of electricity. This calculation, which is the common-sense one, is borne out by ample experience of comparative consumers' bills.

The Expansion of the Lighting Trades: Stagnation in Power Enterprises.

IT is reported by the "Electrician," which has just published a collection of statistics and diagrams relating to the various electricity supply undertakings of the United Kingdom, that the equivalent number of 8-candle power incandescent electric lamps connected to public central stations is 22 millions. This is a statement provocative of thought, and one well adapted to serve as a pendant to the Board of Trade statistics of gas supply recently discussed in these columns. It is the tale of a method of artificial lighting which only dates, as an organized industry, from 1890. If the amount of this growth had been foreseen at that period, the consequence would perhaps have been a "gas scare" as mischievous as that of 1878. At present, it will frighten nobody, but serve to illustrate the development of a business which has dovetailed in a very remarkable fashion into the older and larger lighting industries. It is like a phenomenon of vapour tension. Just as an atmosphere which is saturated with one vapour will absorb another without dropping the first, so the demand of a civilized community for light, and yet more light, appears to accommodate all kinds of illuminants. The question has often been asked, but never answered, as to where the point of saturation for a particular system of artificial lighting should be looked for. Such a question is, by its nature, unanswerable in set terms, because it does not take proper account of the elements that enter into the problem as it exists in civilized communities. If the requirement for light were a fixed quantity, like the demand for some luxuries, it would be easy enough to ascertain its superior limit. But this is not the case. The liking of civilized humanity for light is an appetite that grows with indulgence. Persons barely entering to-day upon middle age, whose recollections go back beyond the introduction of the mineral-oil lamp, can well recall a childhood spent in what would now be considered the "darkness visible" of a candle light. Ever since that period, which had lasted for centuries, the scale of lighting for interiors has risen—at first slowly, and latterly with great rapidity—until the conventional standard by which electricians reckon their lamp connections is itself an anachronism. There are no 8-candle lamps now; the incandescent gas-light has killed them.

Twenty-two millions of 8-candle electric lamps, or half the number of 16-candle lamps, are a good many to be used and paid for by a community which never ceases to demand more gas, lamp oil, and even candles. Unquestionably, unless the taste for more and better lighting had intensified with the facilities for gratifying it, such an addition to the lighting resources of the world would have displaced others, instead of helping to bring them into greater use. At the same time, the demand has a limit, as regards the influence of novelty or fashion; and signs are not wanting that this limit has appeared in sight, if it has not yet been reached, for the most important electric lighting concerns. It has already been noticed that the increased use of gas for street lighting, consequent upon the extension of urban thoroughfares, has resumed its normal course after experiencing a check from the newer fashion of electric street-lamps. The

increased connection to the public supply mains of electric lamps of all kinds is similarly manifesting itself at a diminished rate in the case of the older undertakings, as is but natural. Matters are settling down at last upon the basis of the ordinary growth of the population, and the always heightening appreciation of improved lighting effects—which is a measure of prosperity that all the artificial lighting trades participate in.

While the lighting industries are thus expanding, the special speculation in power supply, which has constituted so marked a feature of the last few years, has not justified the expectations formed respecting it. The "Electrician" is compelled to admit that the progress already made by the electric power companies is disappointing. Only two or three out of the list of power-in-bulk companies authorized by Parliament have begun business; and the Newcastle and Durham undertakings are alone able to make a show of working upon a large scale. It is hardly necessary to remark that we are not greatly surprised at this intelligence; having always maintained that specially favourable circumstances, which are rarely to be met with, must be required to give an enterprise of this character the smallest chance of working at a profit. Our electrical contemporary, while recognizing that the majority of these companies are "extremely slow in realizing the schemes of their promoters," ascribes the delays chiefly to present tightness of the Money Market. Doubtless capital for speculative schemes of the order in question has been hard to obtain; and these power-in-bulk concerns are not the only sufferers.

The Depreciated Value of High-Class Investments.

THE subject of the depreciation of the realizable value of the highest class of investments, which appeals to everybody who has a little money put by, is one of the very gravest concerns of the British public at the present time. This season of the year, when the half-yearly meetings of the banks and discount companies are being held, affords a good opportunity for a survey of the financial position. It is not very comforting to a vast number of small investors to read in all the reports of such meetings now appearing, the same statement, that it has been deemed expedient to write Consols down to 85. Two inquiries are suggested by this common experience—one, as to how the fall in values has come to pass; and the next, as to what has become of the money which it represents. Unfortunately, it is always far easier to explain how a loss happened than to repair it. Therefore, while the exercises of the chairmen of banks and the heads of financial houses furnish interesting reading for those who like explanations, they do not comfort those who have to bear the sad experience of receiving 15 per cent. less than they paid a few years ago for a supposed good security. Explanations, observed Lord Beaconsfield, are dull. Worse than this, they are usually futile likewise; especially when the subject-matter is money lost. It is the fact that stings. Obviously, the best course to be followed in the present juncture, wherever possible, is to sit tight and hold fast, waiting for better days. The knowledge that many people are doing the same thing is not likely to favour the process of the recovery of values. There is but small hope for the rising in market value of goods that are certain to be thrown upon the counter the moment there appears to be a prospect of disposing of them to advantage. Investments properly so called, however, are not like that. The bankers evidently do not think so; for they are with one consent maintaining dividends and writing down Consols out of reserve. This is all very well for those who can stand it. It is the poor realizers on compulsion who are bound to suffer.

One possibly permanent result of the depreciation in the realizable value—we are not contemplating the permanent, or the dividend-earning value—of these high-class investments will be to suggest to the mind of the small capitalist a fresh definition of the word "security," which has been far too lightly applied to all manner of stocks and bonds. Strictly speaking, the only real security instantly available is cash in hand; but this is subject to the drawback of not earning anything. Still, in matters of finance, as in other human affairs, it is impossible to eat one's cake and have it. The bulk of the reserve funds of all traders must be put out at interest; but the eventuality of having to call upon them at short notice is no longer to be dismissed, as heretofore, with the reflection that a holding in such a security as Consols can be realized without loss at any time. If Consols must sometimes be held, and not sold, for fear of a loss, as at the present moment, then the "sweet simplicity" of the investment disappears. It is for this reason that a general depreciation in the quotations for the very highest-class investments, such as the world is now experiencing, is so much more serious and far-reaching in its effects than any amount of oscillation in speculative paper. The security is really no security at all if it is subject to a possible shrinkage of 15 per cent. within a few months.

Moreover, it is vain to put overmuch trust in bankers. This caution seems to be peculiarly applicable to gas companies short of working capital, and to local authorities. There is an ease and celerity about carrying on business by the aid of an overdraft which is capable of seducing the most provident of administrators. As to the small men who so often have a voice in the control of municipal affairs, the degree of their influence may almost be measured by the amount of the customary indebtedness to bankers. It is time to pay heed to the warning that this financial expedient can be, and often is, overdone. Bankers cannot spare all the money necessary for running the statutory supply undertakings of the country. This observation leads to another—the hoary and persistent idea that municipal undertakings possess the advantage—very nearly the monopoly—of cheap capital. Mr. Bernard Shaw, we notice, has just been saying that "such things as tramways, gas, water, and electric "light—the necessities of life for every ordinary citizen—"could not be provided except by public bodies or joint-"stock companies; and the latter could only raise the "capital by promising 10 per cent., and screwing as much "more as they could out of the public by high prices. But "the municipality could raise the capital at 3½ per cent., "and, as it was not concerned to pay dividends, the interest "was the only charge." And Mr. Shaw is reported a clever and well-instructed man! The Chancellor of the Exchequer, speaking in the City of London last week, said something very much more to the purpose. He pointed out that the Government and municipal borrowings of late had exceeded the amount which could be drawn from the accumulated savings of the people, which constitute the only proper and legitimate resources of national finance of every kind. If, therefore, for a short time these highly respectable borrowers can only make it convenient to "go slow," and generally to moderate their demands for further capital, the digestive powers of the community for investments will probably recover tone, and things financial will improve. There does not seem to be anything to add to these words of wisdom, in the circumstances.

Electricity Nearly Half the Price of Gas.

Since the publication of the paragraph under this heading in last week's "JOURNAL," our attention has been drawn to some comments by one of the local papers on the comparisons between the cost of gas and electricity that were made by Mr. C. M. Shaw, the Electrical Engineer to the Wakefield Corporation, in his recent lecture. If Mr. Shaw was unable to convince the people of his own city of the accuracy of his deductions, it is hardly to be expected that he could be more successful with outsiders. Referring to the matter, the "Wakefield Advertiser" points out that Mr. Shaw admits the arc lights cost the city £15 per annum each; while the incandescent gas-lamps cost under £2 a year. The writer then asks: "Will any sane person contend that one of these electric lamps gives as much useful light as seven or eight of the gas-lamps?" This, of course, goes right to the root of the question, and at the same time it is a very simple test; for, as he says, "anyone walking along our streets can settle this matter for himself." No doubt, Mr. Shaw will class the Editor of the paper referred to as one of the "irresponsible persons;" but no one else will be inclined to hold the same view. If people on the spot, who have every opportunity of judging of the relative merits of the two lights, and who know the cost of each, are not in a position to offer a responsible opinion on the subject, who can be? Mr. Shaw, of course, is interested in electricity, as we may be taken to be in gas; but the opinion of the local newspaper Press may fairly be regarded as being entirely unbiassed. Let the Corporation Electrical Engineer first of all convince the citizens of Wakefield. When he has done this, it will be plenty of time for others to try and take his figures seriously. Before leaving the matter, however, it may be useful

to draw the attention of Mr. Shaw to a statement that the introduction of electricity for the public lighting of Canterbury has resulted in the cost to the rates being increased from £1500 to £3274 per annum for practically the same area lighted; "three incandescent electric lamps being required where two of gas formerly were placed, and which would now suffice if the incandescent patterns were adopted." The interesting information is added in a letter published in the Press that the electric lights are "not only derisively pointed at by all visitors, but are considered a total failure by the inhabitants." Here, again, actual experience of the electric light in every-day life does not seem to tally at all with the very pretty theory enunciated by Mr. Shaw. It is over the difference between theory and practice that so many electricians come to grief.

Destruction of Meters by Fire

The case briefly notified in the "JOURNAL" last week, in which the Enfield Gas Company sued one of their customers for the value of a slot meter and fittings destroyed by fire on his premises, raises a point which every now and then crops up in connection with the business of gas undertakings. In this instance, the consumer being a prepayment one, there was an agreement between him and the Company by which he undertook that the meter and fittings should not be "sold, removed, or damaged (fair wear and tear excepted)" while hired by him; and the Judge at the Waltham Abbey County Court decided in favour of the Company's contention that therefore any damage not being wear and tear, no matter how occurring, should be made good by the consumer. It seems that the defendant's wife, who appeared unsupported by Counsel, admitted the claim, and offered to pay a shilling a month. Under these circumstances, the case was not gone into so fully as might otherwise have been done. There were, however, one or two points raised by the Judge in the defendant's interests—the principal one, of course, being whether the Company or the defendant should bear the loss occasioned to the hired goods by accidental fire. This led to the putting-in of the agreement above referred to; and as it was unstamped, the Judge inquired whether it could be accepted as evidence. In answer to this, it was pointed out that, as the claim was for less than £5, no stamp was required; and on this ground the agreement was admitted, and the Judge had no hesitation in finding that the words quoted rendered the consumer liable for the damage, which he ordered should be paid at the rate of three shillings a month.

And the Responsibility.

It seems hardly possible that the defendant could have secured any other decision, even if the case had been seriously contested by him. The moral appears to be obvious. On signing an agreement that he would pay for the meter and fittings if damaged, he should most decidedly have safeguarded himself by at any rate insuring them against fire. This, however, he unfortunately neglected to do; and the Company also stated that they had not covered the meters in the district by an insurance policy. The destruction of meters by fire is perhaps not of sufficiently frequent occurrence to make the question one of cardinal importance; but gas companies who regard it as advisable to hold all consumers (not only the prepayment ones, who are usually more strictly bound than others) liable for any loss that may be sustained in this way, can, of course, do so with the consent of the hirers. Some years ago, in answer to an inquiry which had appeared, the Secretary of a Colonial Gas Company stated in the pages of the "JOURNAL" that he had an agreement signed by every consumer, in which, among other things, the latter engaged to replace the meter in the event of its loss or damage by fire or otherwise. Then, again, during the existence of the Hinckley Local Board, it was decided by them to issue a special notice that they would hold the gas consumers to whom they had let meters on hire responsible for the safe return of them, and that in the case of destruction by fire the consumers should pay the value. If, however, no such arrangement as either of these exists for definitely fixing liability for meters destroyed by accidental fire, and such loss seems likely to occur often enough to justify the expense, the difficulty should be capable of being satisfactorily overcome by means of a floating policy covering all meters which are the property of the gas undertaking.

The Growth of a Corporation Debt.

Mr. Mark Mellers, one of the Nottingham City Auditors, in the course of an address which he delivered the other day, said he remembered the time (as he was first coming into public life) when the debt on the borough was £3000, which was expended on baths. This was the commencement; and in 1851 another £1700 was added. By 1880, the amount had increased to £574,000; and since then it had been growing very rapidly, until to-day the debt, which had started at £3000, had reached £6,500,000. This meant that a cheque for £59,000 had to be drawn every six months, and it also meant that for every child born in the city there was a debt of £25. These figures are striking enough; but, of course, Mr. Mellers emphasized them by means of the now familiar warning regarding the rate of expenditure. Another matter that he pointed out as being one over which the greatest care should be exercised, was the annexing of the profits of a trading concern; for he held that such money ought to be kept in reserve to renovate the plant that was wearing out. We know there are municipal undertakings that suffer owing to a desire on the part of the authorities to show a profit; but Mr. Mellers would seem to have had the Nottingham Gas-Works specially in mind. He said they were told that "the reason of the bad gas was because some of the pipes were worn, and that there was not a sufficient supply;" and that if they had taken care as years went on to renovate that which needed renovation, this would not have been the case. However much, or little, truth there may be in his explanation of the cause of complaints on the part of the Nottingham gas consumers, it would seem that with regard to this department at least the advice given was not new; for Mr. Mellers himself went on to remark that "the latest suggestion was that, instead of keeping in hand for the next year or two the money from the gas to relieve the rates, it was to be used in increasing and properly renovating the gas undertaking." Verily, a borough debt is a wide subject to discuss.

WATER AFFAIRS.

Progress of the Metropolitan Water Arbitration.

THE sittings of the Court of Arbitration under the Metropolis Water Act, 1902, were resumed on Monday last week, after the Christmas recess. Before rising on the 21st of December—the 34th day of the inquiry—the Court had disposed of the cases of four out of the eight Companies, subject to certain points of law reserved; leaving those of the Lambeth, Southwark and Vauxhall, Chelsea, and Kent Companies still to be dealt with. The first of these occupied the Arbitrators for the five days they sat. The Company claimed £5,466,923 for their undertaking (or £5,531,156 without deduction for sinking fund), with something additional for costs incurred up to, and inclusive of, the dissolution; and the Water Board offered £1,000,000 for it. In justification of this offer, their representatives attacked the Company on three points. In the first place, their reservoirs were said to have been badly constructed, and to be inadequate and unsuitable for their purpose without the expenditure of a considerable amount to make them stable. Next, the quality of the water was alleged to be, with one exception, worse than that of the water supplied by any other Company, and the filtration plant deficient to the extent of 11 acres, which would cost £110,000. Lastly, it was asserted that the Company could only claim the right to draw 24½ million gallons of water daily from the Thames; and that the 7½ millions required to make up the 32 millions claimed, which it was said was obtained from gravel beds, really came from the river. On the alleged grounds, therefore, of inferiority of the article sold, and inadequacy of the works to render it suitable for public consumption, the new Water Authority for London coolly offer merely a round million pounds sterling for a concern in which a capital of £2,363,000 is employed, of which the net income in the last financial year was estimated at £163,000, and which has paid maximum dividends since 1897, and is now making up arrears.

Curiously enough, though the reservoirs are said to be "cracking in all directions," Mr. Charles Hawksley could only find one place where there was a sign of weakness; while Mr. James Mansergh attributed the cracks simply to

variations in temperature, and told the Court that there was nothing to denote instability. The only fault he could find was that the work was rough. Mr. E. M. Eaton described the reservoirs as perfectly stable, and remarked that in a mile of monolith some cracks were to be expected. However, Sir John Wolfe-Barry is going to West Molesey to inspect the works; and no doubt, as the President suggested, they will last until he has had an opportunity of doing so. As to the quality of the water, Professor Dewar and Sir William Crookes spoke of it in the highest terms. As to the presence of organic matter, Professor Dewar said this was inevitable in water derived from a river; and when asked by the President point-blank if it was injurious to health, he replied that it was not in the slightest degree. Even Dr. Klein and another witness for the Board had to acknowledge that their examinations of the water had not revealed anything inimical to human life. In point of fact, Thames water is not so bad as they tried to represent it. On the whole, therefore, the Board did not make out a very strong case in support of their preposterous offer. This week the claim of the Southwark and Vauxhall Company is to be considered; and if the present rate of progress is maintained, the Arbitrators will have completed their labours well before the end of next month.

Water Questions in the Court of Appeal.

It is not often that the Court of Appeal is called upon, within an interval of a few days, to review two decisions of Lower Courts on questions connected with the supply of water. This unusual event, however, occurred in the past week; but reports of the appeals are unavoidably held over. On Tuesday, the Lord Chief Justice, the Master of the Rolls, and Lord Justice Romer had before them an appeal by the Mayor and Corporation of Northampton from the judgment of Mr. Justice Bigham upon a special case stated for the opinion of the Court. The amount in dispute was only a few pence more than a sovereign; but its payment had been resisted on the ground that those who demanded it had no legal right to do so. The facts were duly recorded in the "Journal" when the case was in the Court below. The question for decision was the power of the Corporation to differentiate the water-rate. Mr. Justice Bigham said they had not; and the Lord Chief Justice, who delivered the first judgment, considered very carefully the arguments adduced in support of this decision. Under the powers of an Act passed in 1884, the Corporation were entitled to charge for water 7½ per cent. on the net rateable value of the premises supplied, and to make up any deficiency out of the general district rate. In 1900 the borough boundaries were enlarged so as to include Kingsthorpe, where the defendant resided; and one of the conditions of the extension was that for a period of ten years the rates there should never exceed 5s. 6d. in the pound. Consequently, the occupiers could not be called upon to assist in making up the deficiency alluded to. In June, 1901, the Corporation reduced the water-rate in the old borough to 5 per cent., but retained the higher figure in the added portions. By this action, it was contended on behalf of the defendant, he and other ratepayers in Kingsthorpe were prejudiced, inasmuch as the lower charge for water in the borough might result in a larger deficiency having to be made good, which would render more remote the chance of a reduction of the rate specified in the Order. Mr. Justice Bigham decided the case on the ground that there should be absolute equality in the charge for water. But the Lord Chief Justice held that this ground was untenable; and the Master of the Rolls and Lord Justice Romer expressed the same opinion—the former adducing some cogent reasons for his decision, in support of those given by Lord Alverstone. There was another question, as to the meaning of the word "rate" as used in one article in the Extension Order; but in both Courts it was decided that the term did not include water-rate. The judgment of the Court of Appeal was so explicitly in favour of the Corporation, that they deserve to be congratulated on the success of their efforts to have their views of the extent of their powers in regard to water supply upheld by the Supreme Court.

The other case in which the opinion of the Court was sought raised an important question in connection with compensation. The Aspatria and Silloth Joint Water Board desired to construct a reservoir for the purpose of impounding the water of a lake on the estate of Miss Josephine Gough in Cumberland, and they acquired land from her for the purpose. As the lake was a special feature of the estate, the Board agreed to keep it intact, and to pay compensation for the right to flood certain land which was to remain her property. The matter went to arbitration, and Mr. R. E. Middleton, who conducted it, awarded her £8974, which included £4700 for over-water and £1636 on account of the peculiar adaptability of the site for a reservoir. A dispute having arisen over the award, two points were submitted by him for the opinion of Mr. Justice Wright, one of which was whether this "peculiar adaptability" was or was not a proper matter to be taken into consideration in assessing compensation. His Lordship decided the question in the affirmative; and this was the ground of the appeal. The case for the Board was ably argued by Mr. Balfour Browne, K.C., who disputed the proposition that physical adaptability for the construction of a reservoir, apart from the existence of a market for the water which would be contained in it, as was the case here, was a matter which could be taken into consideration in estimating the value of land. Mr. Roskill, who also appeared for the Board, dealt with the question from the point of view of the prospective value of the land taken; and he argued that this must be realizable at a date which was not remote. This, however, was not possible in the present case. Both learned Counsel failed to carry their Lordships with them. The Lord Chief Justice was able to cite an unreported case, in which he had been engaged when at the Bar, which bore specially upon the point before them. It resulted in an explicit expression by Lord Bramwell, in the Court of Appeal, that the element of the adaptability of site was distinctly a ground for enhanced value in the hands of a vendor. In this matter, said his Lordship, the Court had only followed, as they had always done, the recognized practice of experienced surveyors. Mr. Justice Wright's decision was based upon the principle here laid down; and therefore the appeal of the Board failed. The other learned Judges agreed. In the course of the proceedings, Lord Alverstone remarked that Mr. Balfour Browne would have to go to the House of Lords to urge the justice of his proposition. If he did so, he might possibly induce that tribunal to consider it altogether apart from precedent; but as precedent is in this case based upon the best professional practice, we question whether the attempt would be successful.

PERSONAL.

Mr. Ll. Shone has been temporarily appointed Secretary of the Great Marlow Gas Company, in succession to the late Mr. A. D. Cripps.

At the meeting of the Metropolitan Water Board on Friday, Mr. F. E. Harris, the Borough Treasurer of West Ham, was unanimously elected Accountant to the Board, at a salary of £1000 per annum.

OBITUARY.

Mr. William C. Jolly, who died last Friday, at Eastbourne, was for many years Chairman of the Bath Water Committee. Among the work which he saw carried out was the construction of the Monkswood reservoir, which was formally opened in 1897. Deceased was about 78 years of age.

The death took place, on the 20th inst., at Upper Norwood, of Mr. John Ohren Ovington. Deceased, who was 68 years of age, was the youngest brother of Mr. Magnus Ohren, Assoc.M. Inst.C.E., and was his Assistant at the Crystal Palace District Gas-Works. From this position, he went as Engineer to the Longton (Staffs.) Gas Company, and then obtained the appointment of Engineer and Manager to the Rio de Janeiro Gas Company. This latter position he held for about twenty years, when he resigned and returned to England, where he has since resided in retirement.

Transactions of the Institution of Gas Engineers.—The volume containing the proceedings at last year's meeting of the Institution of Gas Engineers has just been issued. The book, which has been edited by the Secretary (Mr. W. T. Dunn), is, as usual, illustrated with several folding plates. As a frontispiece to the volume, there is a portrait of the President (Mr. Andrew Dougall, of Tunbridge Wells); while another new, and very good, feature is an appendix containing abstracts of papers published in various chemical journals. Special interest attaches to this volume, constituting, as it does, a record of the first meeting since the amalgamation of the two Societies.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 233.)

THE Stock Exchange last week had really a much brighter time than they have seen of late, for everything conspired to improve the outlook. The better prospect of avoidance of war in the Far East, satisfactory dividends in railways and other important commercial undertakings, and the continued cheapness of money formed a happy union of factors. So prices were buoyant all round; and they would probably have reached even higher but for the fact of the Exchange being closed on Saturday. In the Money Market, there was a superabundant supply in advance of all demands, and discount rates were much easier. Business in the Gas Market was somewhat irregular—being quite active on some days, with occasional lulls in between; but the aggregate was a fair average. The tendency all round was favourable; and all changes in quotation were in advance of the opening figures. The first incident to set prices rising was the dividend announcement of the Gaslight and Coke Company Directors, to the effect that they can maintain the rate paid for the last two half years, and carry forward an amount greater by £59,000 than the sum carried forward last August, and greater by £110,000 than that carried forward last February. This was gratifying; and the marked price, which was 88⅞ on Monday, ran up to 91, at which figure the stock changed hands more than once on Friday. The maximum stock was also assisted to a rise of a point; but the other secured issues did not profit. In South Metropolitan, there was some quiet business; and the price advanced to 120¾, at which figure the last three transactions were marked—the quotation being 1 up. Nothing at all was done in Commercials. There were two or three transactions in the Suburban and Provincial group; but nothing changed, either in the London or in the Country Markets. The Continental Companies were extremely quiet, but managed one or two rises—Union preference being put up two points, and Imperial one. There was nothing to note in connection with the remoter undertakings. Business in the Water Companies was quieter; the recent considerable recoveries in value having brought the quotations up to figures at which they became less tempting to buy. Still, there were several moderate advances; and the general tendency seems very firm.

The daily operations were: Gas opened very quiet on Monday, and was never busy all the day; but prices were steady. Union preference advanced 2. Tuesday was slightly brisker and firm, without change. In Water, New River rose 5, Southwark 2, and East London 1. Gas was more active on Wednesday, and began to improve. Gaslight ordinary rose 1½, ditto maximum 1, and South Metropolitan 1. In Water, Lambeth rose 5, and East London 1. Thursday fell much quieter; but things were still on the rise. Gaslight ordinary rose ½, and Imperial 1. In Water, Grand Junction rose 1. Friday was very active, and prices were strong though unchanged. In Water, Chelsea rose 2½, Southwark 2½, and ditto preference 2.

ELECTRIC LIGHTING MEMORANDA.

The Result of the Marylebone Ratepayers' Meeting—The Disjointed Nature of Metropolitan Government—Electric Lighting Developments—The Real Meaning of the Marylebone Trouble.

THE unparalleled situation created by the muddle of Marylebone was only aggravated by the result of the statutory meeting of ratepayers of the borough at the Queen's Hall on Tuesday last, when the formal resolution favouring the promotion of the Council's Bill in Parliament was rejected by an overwhelming majority. The proceedings were of so stormy, not to say riotous, a character, that the newspaper reports leave it doubtful whether or not a poll was demanded. But, in view of the circumstances, it may probably be assumed that this step was duly taken on behalf of the majority of the Council, who are naturally most careful not to commit any *laches* that might give a legal advantage to the Electric Supply Company. Of course, it is not in the smallest degree likely that the Bill in question would fare better on a poll than it did at the ratepayers' meeting, which must have been the most important muster of owners and occupiers of the old Metropolitan parish that was ever convened to deal with a matter of local public concern. Yet, as if to illustrate one of the chief and most troublesome of the features of so-called local politics, the principal London newspapers gave no adequate assistance to the inhabitants of the borough in this crisis of their municipal life. Here was an occasion on which the financial integrity and the administrative future of the government of Marylebone were at stake—the amount of money involved being little less than two millions sterling; and the ordinary London newspaper of the day gives more publicity and intelligent notice to a music-hall programme. This is literal fact; and it partly explains the difficulty of carrying on efficient local government in the Metropolis.

The proper consequence of the obscurity in which the work of local government in London is carried on—an obscurity from which the expedient of creating Metropolitan Boroughs has completely failed to lift the work—should be an ever-present sense of insignificance and lack of authority in the minds of those who undertake the thankless task of performing it. The great majority of London ratepayers, many of whom support two different local administrations without giving their minds to either, are almost of necessity content to leave the harmless and indispensable work of local government to a small and socially unimportant class who are usually the relics of the old order of tradesmen who "lived over the shop." This state of things creates a style of local administration of which only the inhabitants of a very few large cities outside the Metropolis have any experience; and even they must have difficulty in realizing how it is in a London district. The Borough of Marylebone is a case in point. At the other end of the town—say, in Poplar—the same state of local affairs is produced by different means. In Marylebone, the aristocratic denizens of the great squares and residential streets, together with the large shopkeepers who help to give the West End its character, pay the bulk of the rates without having a voice in the spending of the money. In the East End, the large industrial companies do the same.

Obviously, to entrust all the powers of modern British Municipal Corporations to such one-sided communities was a risky experiment. It has proved a costly one in several instances; but nowhere such a sad failure as in Marylebone. Circumstances have prevented the Metropolitan and Suburban Boroughs from displaying their incapacity to govern in all the matters that fall within the province of municipal corporations throughout the kingdom—as police, water, gas, main drainage, and so forth. Almost the sole department in which they can go far wrong is in electricity supply; and many of them have lost no time in doing so. As regards Marylebone, this being an inner region of the Metropolis, and one of the best pitches for an electric lighting company, was duly taken possession of very early in the day. Unhappily, the Company who undertook the supply were not at first equal to the work they tried, with the imperfect knowledge and equipment of pioneers, to perform. This led to trouble; and the Marylebone authorities antagonized the Company from the start, with sufficient backing of local opinion to encourage them in the ill-considered purchase and severance scheme. The present muddle is the direct consequence of what has gone before; so that in a sense the Borough Council are not primarily responsible for what has come to pass.

The mistake has lain in the presumption on the part of the old Vestry and the new Council, that the Local Authority could buy out the Company and subsequently carry on the undertaking to advantage. The immediate result of the elaborate and costly arbitration was to show to the least intelligent ratepayer that the grapes were sour. This belated discovery reminds one of the very much more businesslike investigation that was conducted on behalf of the Liverpool Corporation with the purpose of ascertaining whether it would be worth while to acquire the undertaking of the Liverpool United Gas Company, at the price that would probably have to be paid for the property. It was found by Sir W. Forwood's Committee that the suggestion to purchase the gas undertaking was lacking in all essential justification; and it was thereupon dropped without any special harm having been done. The blunder of Marylebone consisted in not counting the cost of the proposed electricity supply deal; and now the ratepayers who would have to find the money decline the bargain. What had best be done remains to be discovered. The ratepayers of Marylebone have thrown over their legal representatives, who are now left to face the triumphant Company with all the strength of the law behind them. It appears that, if the Company choose, they can put an execution into the borough for the amount of their claim; but they would be very ill-advised to use their strength tyrannically. They will surely find it to their lasting advantage to be as merciful to the public, by whose custom they live, as they are strong against the public's discomfited representatives in local government. If we were to argue in the most narrow spirit for the gas interest, nothing could serve better than to irritate the sore. Arbitrary action on the part of the Electric Supply Company would so alienate public feeling, which is fairly touched by all these goings-on, that many of the largest customers of the Company in the district would either cut off the electric light altogether, or supply themselves by the aid of gas-engines. But it would be no compliment to the gas interest to base its revival in Marylebone on a question of pique. It might be argued that the whole proceeding of the Borough Council has been *ultra vires*, as their Act, following the model of the General Act of 1882, is impracticable or defective. In any case, what is wanted now is a measure to clean the slate and make a fresh start, on the basis of bygones being allowed to be bygones. It is an insupportable proposition that the people of Marylebone must be penalized for ever because once upon a time they had a reckless and ignorant Vestry. It would be necessary to review the English reputation for genius in compromise, if no satisfactory way out of the apparent deadlock were discoverable.

It may be as well to make it perfectly clear that the award of the Arbitrator in this case is not in dispute. If the question of price were one between local authority and local authority, or between company and company, it would not have given rise to any such disagreement as that which has divided Marylebone against itself and the Company. Not only have the Metropolitan Company, the owners of the undertaking, offered to rent, at an amount sufficient to pay the interest on the price, the portion

proposed to be severed, but other companies have volunteered to do more. The General Electric Company, for instance, are prepared to take over the business, guaranteeing the interest and sinking fund, and sharing any increased profits with the Council. The Westinghouse Company are also prepared to guarantee that the supply of current in bulk shall not exceed 2·2d. per unit sold, which would appear to place the question of profitable supply beyond doubt. It has been effectively pointed out, however, that this would be no more a municipal supply than the existing arrangement. It is the municipalizing that the local public stick at. They do not believe that their Borough Council are fit to be entrusted with the administration of a trading concern costing a couple of millions sterling, even if the property can be shown to be worth the money. If, therefore, the Council can only justify themselves by bringing in another Company, the element of Municipalism disappears, and the whole business is deprived of justification in principle.

THE TREND OF GAS INVENTION.

For the third year in succession, we have been interesting ourselves in making an examination of the abstracts of specifications published in the "Journal" during the preceding twelvemonth. The study is by no means a tedious one. It absorbs some time; but the interest derived well repays the expenditure in that regard. As on previous occasions, the investigation has proceeded on two lines—first to ascertain how this country compares with, collectively, other countries in new gas invention, assuming that all that is produced abroad and is worth patenting, is protected in this country; and, secondly, to learn the directions in which the minds of gas inventors have been turned, and in which progress is being effected. The point has once before been emphasized that, in making these comparisons, the record of what has been done in Great Britain is set against all that has in the same respects been sent over from other parts of the world. Bearing this in mind, it is no small gratification to find that the figures showing the totals of gas specifications published last year put us in the position of declaring that, in numbers, Great Britain has maintained the supremacy attained in 1902, though there is a little falling off in the difference between the numbers of the native and of imported specifications. But this is a matter of which little account is taken; and it will be quickly explained by the figures referring to incandescent gas lighting. Both, too, from over the seas and at home, the figures present a growth which conclusively proves the existence of a great activity in the gas industry. The numbers of gas specifications of British and foreign origin for the past three years bear witness to this. The total in 1901 was 259; in 1902, 240; and in 1903, 310. These figures mean that gas invention was represented in our pages last year by 70 more specifications than in 1902, and by 50 more than in 1901. If this increasing of the beats of the pulse may be taken as an indication of an invigorated coursing of the industry's blood, it is very welcome; and it presages well.

Of the increase of 70 specifications (while Great Britain holds the lead in the total), other countries yielded 42, as against our 28. But the omission of one item of questionable significance in quality and importance in incandescent gas lighting would turn the scale. Classifying the subjects of the specifications under gas manufacture and utilization, it is found that in variety we far out-distance our friends in other countries, especially from the retort-house up to the point of the delivery of gas to the consumer. It is, in fact, one of the salient and satisfactory features of the year's patent record that gas-works plant and processes are shown to have lately been receiving considerable attention. This is one of the signs of the times; and those signs appear to many to point to a substantial upheaval of old practices, which have served well, in the initial stages of manufacture before there is again anything like the settlement of view that prevailed in the pre-inclined retort days. In those days improvement in carbonization was confined to the raising of the efficiency of horizontal settings, and to the application of machinery for their charge and discharge. In our patent record for last year, inventors are found who are still introducing what they believe are improvements in the horizontal retort-setting; but beyond them are examples of those new machines which have for their purpose the charging of the now recognized standard length of through retort from one end. Interest, too, has not abated in introducing fresh things for facilitating the application of, and the work connected with, the inclined retort system. Beyond these are also noticed the two vertical retort systems which have excited so much curiosity. Does not all this portend change? And may it not account in some degree for the present slackness of which several gas-works contractors complain? A large majority of gas engineers, it may be supposed, are chary about doing anything more than keep their works abreast of requirement in the carbonizing department until experience brings to them the necessary assurance that any advice in respect of innovations will be justified by results. That experience is now being garnered day by day in connection with the newer arrivals—on a practical scale, with the machines that charge through retorts from one end, and with trial installations on the vertical method of carbonization. Verily, it looks from present appearances, as not being much beyond the probable that gas engineers will in future so order their carbonizing plants (by the combination of old and new systems) as to put them in the position of being able to deal to the best advantage, taking all influences into calculation, with any coal or slack that may, through the circumstances of the times, come into their hands.

However, these thoughts by the way. Other systems of producing gas have received a fair amount of attention; and the other classes of ordinary coal-gas plant that have had most work bestowed upon them have been purification and conveying machinery. Continued study of plant and processes appertaining to the bye-products department is evinced; and for the gas distribution system there are novelties—prepayment meters in this section again providing the favourite field for inventive minds. Incandescent gas lighting takes the leading position for prolific output in connection with the utilization of gas, while gas-engines come in as a respectable second.

With this general view, a closer inspection of the specifications in something approaching consecutive order may be made. If inclined and vertical retorts are omitted, it is seen that during the year nineteen specifications were noticed which dealt with retort-house plant and fittings, for three only of which we are indebted to neighbouring countries. Retort furnaces were the subjects of four British specifications; and one inventor in this country is balanced by one abroad for claims in respect of retorts. A multi-tubular retort-setting supplies a unique feature in this section; and its object is to carbonize coal in small quantities, so as to obtain high yields and good qualities of gas from the coal used. Several engineers are asking themselves whether for the purposes of gas production, a mistake has not been made in carbonizing in heavy, thick bulks, and whether better results cannot be realized by modifying the practice. The East Greenwich installation of twenty retorts of small section in a bed comes to mind, as well as the remarkable achievement of the vertical retort at Exeter under the system of mechanical feeding of 6½-lb. charges every 100 seconds or so. Highly interesting is the fact that among four home patents and two imported inventions in charging and discharging machinery are the Parisian and Fiddes-Aldridge machines, both of which their inventors are minded shall be something more than a seven days' wonder. The balance of the specifications in this division refer to the fittings of retort-benches, and a method of charging the producers. There is also a coal-weighing machine, which reminds us that coal weighing into the retort-house is a check on the carbonizing operations that is becoming more widely adopted.

Two systems of vertical retorts which have received frequent mention in these columns during the year came under treatment through the specifications—one being of German origin and the other of English. In inclined retorts, we can claim for this country all the improvement that was made public through the Patent Office in the course of the year—the specifications numbering seven. They were of a varied nature, but the objects are of an external rather than internal character. There was only one of them that attempted to introduce an improvement into the retorts; three referred to the charging arrangements—one notably being a method for varying the inclination of the traversing shoot so as to accommodate itself to the varying physical characteristics of the coal used; and a further one was for facilitating the work of discharging inclined retorts. One inventor turned his attention to the stages of inclined retort-houses; while another made such structural rearrangements in houses for inclined retorts as to largely reduce their cost, an illustration of which is (as readers well know from our published description) to be seen at the new gas-works at Shrewsbury.

Other systems of manufacturing gas were responsible for 26 specifications, of which eleven were exotics. One described a system of manufacturing gas chiefly consisting of methane and marsh gas. There were eight claimants in respect of water-gas plant, five of which came from abroad. Producers of various kinds totalled to eleven, nine of which were of home production, and five of these were specially designed for use with gas-engines. This is a line of development to which a celebrated firm in Manchester have been conspicuously devoting themselves. Proposals for carburetting air and poor gases will apparently go on to the crack of doom; and they were kept in mind in the year by five new comers, two of which had birth in this country. Oxy-hydrogen gas was the subject of one notice.

Leaving for the moment the question of purification, it is to be noted that there is a paucity of improvement in other gas plant right away to gasholders. Matters in these lines seem to have come almost to a standstill. One specification to each is all that can be allotted to exhausters, rotary pumps, condensers, and a method of mixing and measuring gases; while one Englishman takes the credit for two new suggestions (the subjects of separate patents) relating to gasholders. This poor show seems to suggest neglect; but the day of renewed attention is sure to come, as no one can say that finality in the perfection of any one of these types of plant has been reached. This brings us to purification methods and plant, upon which the comment made a year ago was that "an awakened interest has been evinced of late in purification plant by both manufacturers and inventors." That interest shows no sign of abatement in this country. Of fourteen patents, we can claim eleven. The proposals are varied; some of them novel. The three importations can be quickly disposed of. The first has reference to apparatus for purifying gas with liquids; the

second, to freeing gas from carbon disulphide; and the third, to revivifying purifier waste. Those which emanate from inventors in this country are equally deserving—probably, in fairness, more so—of specific mention. One is a combination of ingenious ideas respecting the charging and discharging of purifiers; it provides also for new arrangements of the material in the boxes. Another inventor suggests a method of purifying coal gas which offers the valuable quality of not depriving the gas of its illuminating constituents during the operation. How to eliminate carbonic acid from gas by means of a chloride of sodium and water solution is the subject of a specification; while a further one explains how to purify coal gas and recover bye-products. Centre-valves have been honoured by three additions; while to the credit of washing and scrubbing gas a similar number of proposals has to be placed. The purifying of blast-furnace gas came into notice.

Conveyors and elevators supplied fourteen (mostly) interesting improvements, two of which came from abroad, but one of the latter was by Mr. F. D. Marshall. For the last time, we generously allot his invention to our Continental friends. A noteworthy idea is furnished in the same sphere; the proposal being to collect and transmit the spent charges from retorts in boxes suspended from light railway tracks.

This mention of plant for dealing with one residual affords an easy transition to bye-products of a higher order; and here we have grouped twenty specifications, which embrace only four from other countries. The number is an improvement on the preceding year; and this may perhaps be taken as a hopeful sign. Ammonia production and saturators take the greatest share of the number; the total being seven, six of which are natives. Interest continues to be taken in the question of treating gas for the recovery of cyanides, notwithstanding the warnings as to the limitations of the market. Of course, that is no reason why there should be a cessation of activity in improvement of the means of production; and this is doubtless the view of the one foreign and two British inventors whose new plans were published during the year. The methods of distilling tar received an addition; and there stand one to the credit of this country and one to another, two processes of manufacturing pitch compounds. No less than four specifications dealt with the removal of tarry matters from gas (which doubtless should have come into the section devoted to purification); and there was one plan for removing undesirable matter from water-gas tar, with the view, we believe, of raising its value for boiler-heating. A home production referred to the purification of naphthalene and anthracene; and to balance it—perhaps it does more than that—an inventor from abroad tells how to extract valuable products from spent lime on gas-works. "Valuable products!" Assuredly spent lime will now be looked upon with a more friendly eye.

The record so far, judged by previous years, must be described as excellent; and when we come to the distribution department, the same good record is maintained. There is not a great variety; but on this occasion invention has not been altogether confined to meters. The sum of the inventions in this section is 34, fourteen of which were introduced from abroad. Meters, of course, make the largest contribution; but in regard to them the feature upon which comment was passed a year ago continues. That is as to the little interest that is shown abroad in the matter of prepayment meter improvement—that is to say, if the application for patents here is a fair criterion. While abroad inventors take credit for eight specifications dealing with ordinary meters as against our two, we have twelve improvements to go to our account in respect of prepayment meters, as compared with their three. An improvement, which tends to greater certainty in the registration (on the sudden shutting off of the current of gas) of the well-known "Rotary" meter is recorded; but against it may be set an imported method by which the system of registering the volume of gas has been extended to the simultaneous measurement of its pressure. Mentioning meters gives the opportunity of bringing into notice a coin-counting machine. In outside work, there are three home productions, dealing with the plugging and caulking of pipes and the furnishing of supports in the laying of mains. Of three new gas governing arrangements, we can only claim one.

This brings us to the utilization of gas; and there the greater number of patents are in the lighting class. When it is stated that the specifications of which abstracts were given in these columns—covering all sorts of things from burner-cocks to gas-compressing machines—totalled to no less than 130, it will be seen that we could not in a reasonable space distinguish in every item between the output of this country and others. Contentment must be found in a few general observations. It is remarkable how decidedly attention has been diverted from ordinary burners to incandescent burners, mantles, and their accessories. Throughout the whole list, the only specification that can be discovered referring particularly to ordinary burners is one from abroad, which alludes to the manufacture of burner-tips. High-pressure lighting continues to have good support among those who study the system with a view to improvement in details and to enhancing efficiency. The acceptance by the public of the inverted gas-lamp is, as is always the way, directing the interest of inventors more and more in that direction. But out of eight lamps described, England can only take credit for one. While a few years ago circumstances then existing retarded active work in incandescent burners and mantles in this country, it is found now we are getting well on a level with other countries; and if the survey were extended to the whole range of lamps and fittings connected with this system of lighting, and the numerous imported systems of lighting and extinguishing burners were ignored, we should in this department be well abreast of our friends abroad. But those systems of lighting and extinguishing are accountable for the substantial number of 23 foreign proposals, as against five from this country. The fever in connection with burners and mantles appears to have run its course; but it seems inevitable that the malady should break out in some fresh quarter, and this is where it is found. We will not remark upon the character of some of the ideas in this line; but it may be said, without fear of the future bringing contradiction, that nothing more will be heard of many of them. Anti-vibrators have offered another field for activity; and simple indeed and apparently without value are some of the suggestions. Connected with lighting, appliances for testing for various purposes were represented by two home patents and two from abroad—the most promising one being the "Flicker" photometer.

Cooking and heating stoves still receive scant notice, so far as really patentable invention goes. Protection has been sought in respect of fourteen subjects referring to burners and parts; but there is nothing of such a striking character about them that they need be specially noticed. However, only four of the specifications referred to home inventions. In regard to gas-engines, there appears to be a lull in invention connected with the powerful monsters that caused, for a period, so much excitement on the Continent and later in this country. But in such improvement as there was, this country stands well; having to its credit nine specifications out of a total of fourteen.

The days of acetylene do not brighten with the progress of time; and obviously inventors do not find it a profitable field. There were only six specifications in which acetylene was mentioned that were regarded as of sufficient interest to call for notice; and they were equally divided between home and abroad. Four of them referred to burners; one to an oxy-acetylene light; and one (how hath the mighty fallen!) to an application of acetylene to torches for lighting street-lamps.

This ends the review of the year's "Register of Patents." If the record of twelve months ago pleased, then this one gives us immense satisfaction—both in the position that this country occupies in the comparison, and in the remarkable new entries that have been made in the history of coal-gas manufacture.

RECENT COAL AND PETROLEUM STATISTICS.

As is always the case, there is a good deal of very useful information given by Dr. C. Le Neve Foster in Part III. of his Home Office report and statistics on Mines and Quarries. The report last issued embraces, among other things, a general notice and statistics as to the output and value of the minerals raised in the United Kingdom, together with figures relating to exports and imports. At the outset it is stated that the value of the minerals produced in this country during the year 1902 from the mines and quarries which come within the provisions of the Act under which the returns are received, was £107,104,884, or a decrease of £8,000,000 compared with the preceding year—a reduction accounted for by the lower prices paid for coal.

Turning to the portion of the report in which "JOURNAL" readers are interested, it is found that the total output of coal in 1902 amounted to 227,095,042 tons, which is the largest figure on record—exceeding as it does by 1,913,742 tons the quantity produced in 1899. The increase over 1901 was 8,048,097 tons; and this greater output was due mainly to the larger number of persons employed, though a small share of it was accounted for by a slight increase of 5 tons in the yield per underground worker. Of the total output, 45,252,019 tons were exported as coal and its equivalent in coke and patent fuel, against 44,196,243 tons the preceding year. But though the shipments reckoned in this way constitute a record, the amount of coal exported as such for use abroad (43,159,046 tons) has been exceeded on one occasion—namely, in 1900, when the figure reached 44,089,197 tons. The declared value of the coal exported in 1902 was £26,307,351, as compared with £28,744,984 in the preceding year—showing a decrease of £2,437,633, though the amount of coal sent out of the country was more by 1,281,965 tons.

This, of course, brings us to the question of prices, which our readers do not need to be told were decidedly more favourable to buyers than in the two preceding years. Precisely what was the extent of this gain will be seen from the following figures giving the average prices per ton at the pit's mouth for the three years: England—1900, 10s. 6d.; 1901, 9s. 1d.; and 1902, 8s. 1d. Wales—1900, 12s.; 1901, 11s. 11d.; 1902, 10s. 7d. Scotland—1900, 10s. 10d.; 1901, 7s. 11d.; 1902, 6s. 8d. The mean prices in the London market per ton of seaborne coal put into barge from ship in the Thames were: 1902, 18s. 1d.; 1901, 19s. 5d.

The table showing the quantity of coal, culm, and cinders imported into the United Kingdom exhibits a falling off of more than 50 per cent. in 1902 as compared with the previous year; the quantity being 3279 tons, as against 7564 tons. Of this amount, France favoured us with 220 tons, in return for the 7,600,111 tons of coal, coke, and patent fuel taken from this

country; Germany sent 545 tons, and received 5,835,644 tons; while Italy exported none to the United Kingdom, but had from us 5,994,910 tons. America would appear to have practically ceased her attempt to obtain a footing in our market—for the time being, at all events—for in 1902 we only received 195 tons from her Atlantic ports, sending at the same time to the Atlantic and Pacific ports 880,407 tons. More than half the quantity of the coal, &c., imported came from Holland; but even in that case the amount was an utterly insignificant one—only 2313 tons, as compared with the 759,972 tons taken from us. It is pointed out that, in all the statistics, the term "coal" includes anthracite, the total output of which in this country in 1902 was nearly 3,000,000 tons.

As bearing somewhat on the question of coal, mention may be made of two other matters referred to in the report. The first of these is natural gas, with regard to which it is stated that the amount supplied during the year 1902 at Heathfield, Sussex, was 150,000 cubic feet, valued at £30. It is, however, added that during the March quarter of 1903 the quantity obtained was 250,000 cubic feet. The other item is petroleum, which "is not absolutely wanting in Great Britain." In recent years, small quantities have been obtained in North Staffordshire; but in 1902 Yorkshire was the sole producing county, the output being 25 tons, of a value of £60 at the mines. In 1886, there was a production of 43 tons in the United Kingdom; and in 1893 the figure rose to 260 tons. The following year, however, there was a drop to 49 tons, since which time 1902 shows the heaviest yield.

In conclusion, it may be of interest to reproduce the figures from the table of imports of petroleum into the United Kingdom. They are stated in gallons; the value being given in parentheses: 1901—From Russia, 78,206,984 (£1,352,213); United States, 162,791,889 (£3,472,354); other countries, 12,785,873 (£246,135); total, 253,784,746 (£5,070,702). 1902—From Russia, 88,203,088 (£1,405,365); United States, 184,445,173 (£3,542,435); other countries, 12,161,449 (£245,782); total, 284,809,710 (£5,193,582).

WATER BILLS FOR 1904.

The following Bills relating to water supply by Companies have been deposited in the Private Bill Office:—

The Barnet District Gas and Water Bill is to empower the Company to make additional water-works, including a new well and pumping-station at Little Berkhampstead, Hertfordshire. New lands are to be acquired within five years; and the works are to be completed within ten years. Cisterns are to be provided within the whole of the limits of supply, notwithstanding that water is laid on constantly under pressure. Owners of property let for short terms are to be liable for water-rates. Flats are to be regarded as houses. A constant service is to be provided within parts of the district not higher than 400 feet above Ordnance datum after the completion of the new works. Local authorities within the limits of supply may contract with the Company by way of guarantee or otherwise. A water supply of the Company for domestic purposes is not to include a supply for use in workhouses, hospitals, barracks, or large buildings occupied by persons living in community for sanitary, educational, or religious purposes. It is desired to raise a further amount of £250,000 in the form of "D" water capital, with one-fourth loan. A clause is inserted to make full compensation payable for damage to mains or pipes by electric action.

The Bexhill Water and Gas Bill proposes to empower the Company to construct new works, including wells and pumping-stations in the parish of Ninfield and the borough of Bexhill, to be completed within ten years. The Company desire to raise additional capital of £120,000, with one-third loan.

The Brymbo Water Bill is to authorize the Company to extend their limits of supply to certain parishes and parts of parishes, in the counties of Denbigh and Flint, lying outside the area of the Wrexham Water Company. It is desired to raise £25,000 of additional capital, with liberty to offer unsold issues to employees and consumers. The borrowing powers are to be in the proportion of one-third. Supplies by meter are to be chargeable at the price of 2s. per 1000 gallons, such charges not to be less in amount than the rates which would be otherwise levied on the premises so supplied. Power is desired to acquire lands for preventing the fouling of the gathering-ground, and for the execution of works necessary for the same object.

The Gosport Water Bill is to authorize the Gosport Water-Works Company to make additional works, including a well and pumping-station at Droxford, and another at Bishop's Waltham, to be completed within five years. Additional lands are required. After the proposed works have been constructed, it is intended to discontinue the pumping-stations at Foxbury and Bury Cross, in the parish of Alverstoke, Hampshire, and dispose of the sites. The limits of supply are to be extended. The capital is to be increased by £80,000, with power to borrow one-fourth of the amount. The holders of more than three-fourths of the existing preference stock of the Company have assented in writing to the creation of further preference stock to rank equally with it. Owners of houses not exceeding £12 rental value are to be liable instead of the occupiers to pay the water-rates. Sanction is required for the purchase within three years of the undertaking of the Lee-on-the-Solent Water-Works Company, Limited.

The Littlestone-on-Sea and District Water Bill is to incorporate a Company for supplying with water the district named, in Kent, as successors to a private undertaker who is practically the owner of the hamlet. The district of supply is to be the area and neighbourhood of Romney Marsh; and the supply is to be made effective within five years. The capital of the Company is to be £36,000, with one-third loan. The works to be authorized consist of wells and pumping-stations at Lydd. The existing private works are to be purchased by the Company if required by the proprietor. The rates chargeable for domestic supplies are to range from 7½ to 6 per cent. Water supplied for other than domestic purposes is to be charged for by a minimum price of £1 per half year and 1s. 6d. per 1000 gallons up to a yearly consumption of 20,000 gallons, and 1s. 3d. beyond. Charges for supplies to public institutions are to be by agreement.

The New Romney and Lydd Water Bill appears to relate to the same locality as the foregoing. It is to incorporate a Company for the supply of water to the Romney and Lydd district, but excluding the Littlestone-on-Sea Estate, unless by consent of the owners. The capital of the Company is to be £15,000, with one-third loan. The proposed works are to comprise wells and pumping-stations at Lydd, to be completed within two years. The rates for domestic supplies are to range from 10 to 6 per cent., with 10 per cent. reduction to compounding owners. The price of water sold by meter is not to exceed 1s. 6d. per 1000 gallons, with 1s. 3d. per 1000 gallons for sanitary purposes.

The Amersham, Beaconsfield, and District Water Bill is to extend the limits of supply by the Company so as to include the parish of Gerrard's Cross, Buckinghamshire; the supply to be made effective within six years. Additional lands are to be taken, and a pipe-line constructed, to be completed in five years.

The Newcastle and Gateshead Water Bill is to extend the limits of supply to include a number of parishes and places in Northumberland. Additional works are to be constructed—the principal being service-tanks. Additional lands are required in Newcastle. The sum of £150,000 is required to be raised as 7 per cent. ordinary or 5 per cent. preference stock, with one-third loan. Demands not exceeding £100 are to be recoverable in the County Court.

The New River Company's Bill is to make provision for the application and distribution of the water stock issued to the Company in discharge of the sum payable as compensation for the transfer of their water undertaking to the Metropolitan Water Board; and for the reconstruction of the Company and its registration as a limited company. The preamble of the Bill recites the history of the undertaking from the issue of the patent of King James I. to Sir Hugh Myddelton and the 28 adventurers therein named, dated June 21, 1620. In the Metropolis Water Act, 1902, prescribing the sale of the Company's water undertaking, the landed estate was reserved. The Bill deals first with the distribution of the water stock allotted to the Company. It is proposed that, as from Jan. 1, 1905, the Company is to be registered and continue incorporated under the name of the New River Company, Limited; and King James's Charter, before-mentioned, is no longer to apply to them. The capital of the joint-stock Company is to be in £1 fully-paid shares, which are to be dealt with as land until sold. An examiner of title is to be nominated by the Senior Judge of the Chancery Division to deal with holdings in the Company. The Memorandum and Articles of Association of the new Company are scheduled.

The City of Norwich Water-Works Company's Bill is to empower the Company to increase their share capital by £160,000 to be raised as 6 per cent. ordinary or 5 per cent. preference capital, with one-fourth loan. The auction clauses are to apply to debenture stock issues.

The Rickmansworth and Uxbridge Valley Water Bill is to extend the limits of the Company to include Gerrard's Cross and other parishes and places in the counties of Bucks and Hertford. The supply is to be made effective in the extended area within five years. Power is sought to dispose of surplus lands.

The Southend Water-Works Bill is to enable the Company to raise £184,000, subject to the provisions of Part II. of the Companies' Act, 1863, bearing 5 per cent. dividend, whether raised as ordinary or as preference capital. The borrowed money is to be in the proportion of one-fourth. Debenture stock issues are to be under the auction clauses.

The Ticehurst and District Water and Gas Bill is to amalgamate the undertakings of the Ticehurst and Robertsbridge Water Company and the Wadhurst, Ticehurst, and District Gaslight and Coke Company. The Water Company were incorporated in 1902, have issued capital to the amount of £7000, and have borrowed £2000 on debentures. The Wadhurst Gas Act, 1902, incorporated a Company with authority to purchase the undertaking of the Ticehurst Gas and Coke Company, Limited, which they have done, and have also purchased a private gas undertaking at Wadhurst. The capital of the Gas Company amounts to £15,000, with debentures to the amount of £5000. It is submitted that the undertakings of the two Companies could, with advantage and economy, be amalgamated. The district of the amalgamated Company is to be extended to include the parish of Heathfield, Sussex. An additional supply of water is to be obtained from a well at Ticehurst; the new works to be completed within five years. Additional capital to the amount of £10,000, with one-third loan, is required. Preference shares are to be sold under the auction clauses.

MR. FLETCHER MOULTON ON INVENTORS AND INVENTION.

For an hour and a half last Friday evening, a considerable number of the members of the Junior Institution of Engineers, assembled at the Westminster Palace Hotel, had their attention riveted by the words which their President for the year, Mr. J. Fletcher Moulton, K.C., F.R.S., M.P., addressed to them. It was his Inaugural Address, belated by reason of the work connected with the eminent position he is occupying in connection with the great Metropolitan water arbitration. As was peculiarly appropriate, he took Invention as the subject of his address; and his utterances are of importance and applicable to every class of inventor, no matter the line of his work and achievements. Naturally, in view of his audience, engineering invention was the dominant note. The learned President's connection with engineering and mechanical science has, of course, been that of a spectator, watching, it is true, with deep interest its struggles and triumphs, but taking part in neither. But "lookers on see most of the game" is a proverb resting on a sound scientific basis; and in one aspect, Mr. Moulton can claim that the whole field of practical science has been under his observation for many years. It was from this point of view that he treated it in his address, from which we give extracts without, it is hoped, spoiling its contiguity. Even in the parts in which the President's own words are employed, there has been, it should be understood, considerable curtailment.

To understand and appreciate invention aright, it is, he said, necessary to have a clear view of the world of thought and work in which it takes place. One of the commonest and most fatal errors committed by would-be inventors is to view invention as if it had no past—as though the casual "happy thoughts" of those who are ignorant of what the world has already done merited its title and its rewards. From this source come most of the bitter disappointments that the President has so often witnessed in his practice as a patent lawyer. We must not fall victims to any such delusion. Invention has been busy in the past; and it has left to the inventor of to-day a rich heritage of knowledge; and, while he has its help in his onward struggle, he has also its responsibility. The growth of mechanical science widens as well as narrows his field. It opens out to him new possibilities, it is true; but, on the other hand, every advance in knowledge takes so much from what, up to that time, belonged to the field of invention. Nor is this only true of to-day. Even if we go a long way back into history, we still find that the inventor had at his command a formidable armoury of weapons in the shape of mechanical arrangements and combinations which belonged already to the domain of public knowledge. To this groundwork of knowledge the President gave a considerable amount of thought before passing to the achievements of invention—quoting and enlarging upon examples of the great fundamental elements of mechanism, and then producing further ones to show how new mechanical elements bring with them new powers and new liberty, giving rise to new types of machines. He lingered long over the equipment of the engineer, and then turned to his task. He did not attempt to include the whole vast domain of invention in his remarks, but limited himself to types; and the class of invention which he chose were those whose object is to produce by mechanical means articles that otherwise must be produced by hand work.

We cannot follow the President, notwithstanding the interest, through this part of his address; but two of his points may be lifted from the surrounding matter. Under the changed circumstances, he holds, there is no ground for assuming that the mode of performing the operation that has been proved to be the best for handiwork will be the most suitable for doing it by mechanism; and the first—and most important—task of the inventor, therefore, is to decide whether he will adhere to the hand cycle or will rather substitute for it some equivalent cycle, producing the same results, but better suited to the new conditions—to the strength and weakness of the inanimate. The inventor has to find a series of operations, which in their totality are equivalent to the series of the hand worker. But each of these operations in itself needs not be such as would in hand labour be suitable or even practicable. It is necessary and sufficient for him that they are suited to the new conditions—*i.e.*, that they can be well and easily performed by mechanism, and that, taken as a whole, they produce the same result as the series which he is paralleling. And later on he remarked that there are types of inventions in which the whole invention may be said to consist in the choice of a cycle—for example, the processes of shaping metals by pressure, the rapid development of which has been so characteristic of the last twenty years, and the promise of which is still so brilliant.

When the cycle has been determined upon, there remains the task of providing the means for carrying it out—in other words, the designing of the new machine. On this part of the subject he did not dwell, because the devices which human ingenuity makes use of to effect its objects are so multifarious as to defy classification. Nor does the progress of invention come to an end when the machine has been devised. It then becomes the subject of further invention, the aim of which is to arrive at better results by modifying or changing, or adding to the mechanism. This is the most common type of invention. Long after a fundamenta invention has been made and embodied in some form of mechanism, new inventions will appear, which are, or claim to be, better methods of carrying it out in general, or which adapt it to be used with more effect in special, circumstances. Such subsidiary inventions usually consist in the substituting for the mechanical devices originally used other equivalent devices better suited to the work which they have to perform—the machine in its essentials remaining unchanged. And though this judicious adaptation of means to ends may seem less brilliant and interesting than inventive efforts previously considered, it is hardly less useful. To increase the output of a machine, or make a delicate machine equal to rough work, is no mean achievement, and may vastly extend or even create its practical usefulness.

With a few omissions, the address proceeded: It is here that the lawyer's difficulties are greatest. The benefits of the Patent Laws are confined to inventions; and it therefore becomes necessary, in deciding whether a new machine or a modification of an old machine is good subject-matter for letters patent to put to oneself the question, "Does it involve Invention?" The decision is not difficult when it involves a new cycle or a wholly new mechanism for accomplishing an old cycle. But when it consists of an improvement on old mechanism by the substitution of different but equivalent devices, the task is one of great nicety. It would seem to be necessary to fix upon some definition of invention; but this has never been done, and, in my opinion, no definition of invention can be found which is of the slightest assistance to anyone in a case of difficulty. It is very much like deciding whether a book belongs to literature. No one would deny it in the case of Ruskin's "Modern Painters," or assert it in the case of "Bradshaw's Railway Guide." These extreme cases are easy of decision; but when you approach the dividing line, it is so impossible to get a test that it becomes, more or less, a matter of personal opinion. Some of the elements of a combination are altered so as to improve, but not essentially change its working. Is that a new invention? If it is only the substitution of mechanical elements which are notoriously the equivalent of the old elements, the law is clear; but in any other case it is treated as being a question of fact for the judgment of whatever tribunal has the duty of deciding. Our Courts, in this, as in many other questions, lean to the practical rather than to the dogmatic. They impose no rigid test such as that to which the German Patent Office inclines—viz., that the new combination must produce a different technical result. To do the same thing better, or in a way so different that it gives to the public a useful choice of means, may with us be sufficient to support the claim to invention. And I have little doubt that, if a case should arise in which a judicious selection out of the list of known and notorious mechanical equivalents gave an unforeseen and markedly superior result, the Courts would consider themselves free to hold it to be invention; and in treating the decision as thus dependent on the resulting utility, they would only be following the dictum of Lord Watson: "There are many things which you cannot say are, or are not, inventions till you have tried them."

"Have something to say, say it, and sit down," was the reply given by a parliamentary veteran to a new member who asked for advice as to how to speak. How often have I wished that inventors would take this counsel to heart in all its fulness. They often have something to say, and they say it, but they will not then sit down. It is not that I would have them rest on their oars; but I would have them bear constantly in mind that the value and the reward of an invention comes when it has been made practically serviceable to mankind, and that the invention itself is but the first and perhaps not the most difficult step in the process. Careful and patient development along commercial lines is necessary before an invention, valuable in itself, becomes a useful part of our system of production; and here the enthusiasm and knowledge of the inventor would be invaluable if it were well applied. I am one of those who believe that, *cæteris paribus*, the mother is the best nurse. But, alas! this is where inventors so often fail. They are never content to work out practically what they have invented. Fresh inventions are their remedy for every difficulty, even for such as naturally occur in all industrial developments; and thus perpetual change leads to delay, loss, and final abandonment. "*Le mieux est l'ennemi du bien*"—"The better is fatal to the good."

The leaving of their work in an incomplete and useless state is the most common fault of inventors. They have not the patience to develop their inventions to the stage of practical reliability; and they leave them useless, except to testify to the ingenuity of the mind that devised them. I suppose that I, of all men, should feel sympathy with these unrewarded workers; but I confess that, in my secret heart, I consider them an almost unmitigated nuisance. They accomplish nothing useful themselves, and they detract from the merit of those who, by greater perseverance and more patient labour, have succeeded where they failed. Their inventions attain posthumously a short-lived forensic glory by being paraded as anticipations of some later invention that has proved itself of sufficient value to be worth defending. The resemblances are pointed out in order to discount the originality of the successful invention, and oft-times it has to be admitted that the kernel of the later invention is to be found in its predecessor. But I am happy to say that, when an inventor is modest in his claims, and seeks only to protect that which he has in fact made practically useful, the tendency of the jurisprudence of our country is to pay little heed to antecedent incomplete or useless

attempts. I have long contended, and I think it is now settled law in our Courts, that an invention is not made until it has been developed so far that the normal result of its working is success. Uncertainty in result beyond this point means practical uselessness. And as it in fact leaves the field still unoccupied for future inventors, so it should do in law; and their fame and their reward should not be lessened by the useless half-successes that have preceded them.

I shall be told that I am too hard upon the inventor in holding him responsible for commercial non-success. It will be said that the practical development of an invention is not the business of the inventor, and that the qualities of mind that characterize him unsuit him for the task. Unvarying repetition is the key to commercial production, while the inventive genius yearns for change. There is much truth in this; and the strongest and most successful combinations are those in which both elements are represented in different individuals, the more practical being the dominant one. It is in this that we are so far behind our great rivals—Germany and the United States. I am not going to weary you with a description of the laboratories of research which exist in all the great chemical works in Germany. This has been so much dwelt upon of late that I only refer to it in passing as an eminent example of this union of invention with a system of practical development. But what is not so widely known is that in the United States the same thing is done in connection with mechanical inventions. Men possessing inventive genius of a high order are maintained as part of a business organization for the express purpose of making inventions which, when made, are duly tested, and, if found of practical value, are exploited on a large scale—the inventor reaping thereby his reward. It is by this that I explain the fact that the successful machines of to-day, and more especially those of a complex type, or that form elements of a series, are mainly of American origin. I see no reason to think that we are individually inferior to Americans in inventive faculty; but unquestionably English capital is, as a rule, in less enterprising hands. Our great business firms are inclined to put off taking up new inventions until competition has forced them to do so; and they are still less disposed to look on invention as forming an essential part of business. In saying this, I must not be supposed to be applying the criticism to all. Happily there are among us most brilliant exceptions; but the tendency of the successful among us is to rest in the old ways, while our great rivals are throwing so much of their strength into the discovery of new ones. It is in consequence of this that the development of new inventions in England falls so much into the hands of limited liability companies specially formed for the purpose; and this is far less likely to bring success than if the inventions were developed by existing firms or companies. Joint-stock enterprise of the commercial type is so far inferior to individual enterprise that it rarely succeeds [aside the President remarked: "I believe that 95 per cent. of such joint-stock companies fail"] unless it is the embodiment of the individual work of one or two individuals; and in the case of companies specially formed to work inventions, it too often happens that the management of the company is in the hands of the inventor himself, who possesses little or none of the commercial training necessary for success. Looking back, I can think of no few inventions which, in wise hands, would have produced enormous returns, but which have, for these reasons, produced little or nothing, or even been a source of loss.

In what direction is invention trending? In two directions which are well-nigh opposite, or I ought rather to say complementary, the one to the other. On the one hand, the tendency is to divide manufacture up into many simple operations, each capable of being performed swiftly and well by a special machine designed solely for the purpose, and thus working under the most favourable circumstances for cheapness of production. This tendency to subdivide the operations of production until they are each capable of being performed either automatically or with unskilled labour, is having momentous effects in labour questions. Strange to say increase in accuracy of workmanship is tending to increase the demand for unskilled rather than for skilled labour. The skill which used to be sought for in the workman is now embodied in the machine. This is due to what I may term the uniformity of mankind. The chief wants of each class are common to all the individuals that form it. Hence any rise in the standard of comfort of a nation produces a demand for millions of articles of one and the same class—precisely such a demand as can be best satisfied by the unvarying but economical production of machines of the type of which I have spoken. I have no doubt that the growth of production as a whole will be so rapid that the total demand for skilled labour of all sorts in manufactures will not actually diminish; but I am equally sure that relatively to substantially unskilled labour, it will be less and less used. Rough and brutalizing labour will be done away with; but its place will be taken by unskilled, rather than skilled labour. Side by side with the tendency towards highly-specialized machines, each doing one small and separate operation, there is the other line of invention—*i.e.*, of machines which combine—I would prefer to use the mathematical term "integrate"—a whole series of successive operations, and turn out a completed article. Here we find perhaps the greatest inventive triumphs of our time. It is difficult to say which class of machine is attracting most attention—whether combination or division of operations, synthesis or analysis, is taking the lead. If success is completely attained, the machine that combines in itself the whole series must always gain the day. But the penalty for falling short of perfection is heavier, and the danger greater. Each step brings its own liability to failure; and the failure of a step has more serious and more far-reaching consequences. Yet we have abundant proofs on all sides that human ingenuity is equal even to this severe task.

Those whom I am addressing are chiefly in the early stage of their professional career. How do I wish them to regard invention? Should they all aspire to a share in it, or is it to be reserved for a chosen few? To answer this question, I must go back a little, and recall to your minds the aim of invention. It is to enable mankind to do some new thing or to do an old thing better or cheaper or more swiftly. It is accomplished by a more judicious adaptation of means to end. If we cease troubling ourselves about the arbitrary line which, for certain legal purposes, is drawn so as to delimit invention, we may look on all those who are engaged in improving mechanical appliances and in advancing practically mechanical science as fellow-workers in one common field. In this sense, you may all hope to be inventors; and it is this conception of your calling that I would impress upon you. Do not seek originality or change for its own sake. Have a single eye for efficiency, and be content with the work of others until you can surpass it—remembering always that well-trodden paths are easiest to walk in, and that it needs some substantial gain to warrant your leaving them. But never lose hope that you may be able at some time and in some way to help the advance of science by some contribution of your own which may merit, in every sense, the title of invention.

Is this wise advice? Can one allow oneself to taste the fascinations of invention, and not be led astray into fruitless and desultory quests after some new thing? The danger exists only for those who are superficial in their work. The wider and more thorough a man's knowledge, the less likely is he to overrate his own powers, and, by thinking himself a universal genius, be led to waste his life in futile endeavours to do everything. Indeed, the danger is rather that he will be too much discouraged. He will find that so much has been done so well by others that he will despair of accomplishing anything new that is worthy to be ranked with it. But a little discouragement will not hurt him, so long as it does not lead him to abandon the training that is to prepare him for the moment when he finds his right task.

And here let me put in a word as to this training. I am not going to enter upon the vexed question of Technical Education. I am going to remind you of the metaphor I used some little time ago when I compared invention in a machine to literary merit in a book. I want you to look upon famous inventions as a scholar looks on the works of our great authors. He reads them not only to enrich his vocabulary, but to teach himself consciously and unconsciously how those words can best be used. You cannot read an essay of Macaulay without learning something more of the powers of our language. So is it with the machines of the great inventors. They are your literature. You cannot master their construction without getting a firmer hold of the resources of mechanical science. My advice to you is study your machines. Never miss an opportunity of examining those whose merit is well established, and which have played a great part in the world of industry, even though they may not belong to your special branch. Try to appreciate the task their makers had set before themselves, and the steps by which they performed it. I wish I had time to take examples of the glories of practical science, and show you how the great inventors overcame or evaded difficulties; how they at times persevered almost to obstinacy, and at other times threw away all the results of years of labour because they saw success attainable in another direction. But you will find out all these things for yourselves if you will but study great inventions; and while the study makes you feel humble before those who have done such marvels, it will leave you all the more eager to emulate their achievements.

And remember, the future is in the hands of the inventors. No invention can live that does not cheapen production—*i.e.*, that does not lessen the amount of human labour needed to produce a given result. Hence the ratio—if I may use such a phrase—between labour and its results is ever increasing with the progress of invention; indeed, if we take the word in its broad sense, we may rightly say that this ratio is fixed by invention. This ratio, which represents the fertility of labour, measures the wealth-producing power of the world. It defines the amount the individual can contribute to the common store by his own labour, and conversely it limits the share which he may hope to receive from that store. You will think me too optimistic in putting the proposition in this its converse form. We know that too often what a man receives differs widely from what he contributes by his labour. Creation of wealth does not necessarily bring with it distribution. But in this respect invention is on the side of the masses. Production is aided by it only on terms of the uniformity of the article produced. Hence the characteristic effect of invention is to bring within the reach of the many that which previously belonged only to the few. Products of manufacture under the influence of invention become accessible to an ever wider and wider class. It has responded to the demands for a higher standard of comfort; and it stands ready to respond to whatever such calls are made on it in the future. If it has not done more, it is because mankind has been too easily satisfied with lower pleasures. But with the growth of education, and the spread of civilizing influences of all kinds, we trust that this will be so no longer. And I can wish no better future for those whom

I am addressing, than that they may be sharers in those triumphs which the future still holds in reserve for invention.

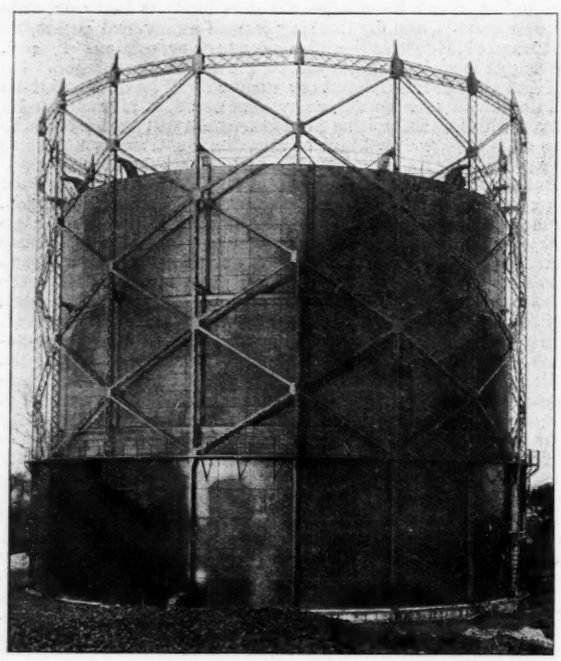
Mr. SAMUEL CUTLER, jun., the Chairman of the Institution, moved a hearty vote of thanks to the President for his excellent address—remarking that, from the moment Mr. Fletcher Moulton accepted the presidency, the members had been eagerly looking forward to that evening, knowing well that they would hear a great deal to their advantage, and much of interest and of value. He assured the President that the address would not only act as an incentive to those members who had had the pleasure of hearing it, but it would also stimulate those who were situated in the country and in distant parts of the world.

Mr. F. S. PILLING seconded the motion; and Professor AYRTON supported it.

A very enthusiastic endorsement was made by the members; and the response of the PRESIDENT ended the meeting.

THE NEW GASHOLDER AT GUERNSEY.

In our issue of the 5th inst., we recorded the inauguration of the new gasholder that has been recently erected at Bouet for the Guernsey Gaslight Company, by Messrs. S. Cutler and Sons, of Millwall; and we are to-day enabled to give an illustration of this important addition to the Company's plant. The tank, which is constructed of mild steel, is 104 feet in diameter and 26 feet



deep; and the holder is in three lifts, rising 75 feet, with a capacity of 550,000 cubic feet. The guide-framing is on Cutler's patent system. A feature of this framing is the complete triangulation by latticed braces, which produces a structure of great strength and pleasing appearance.

THE INCANDESCENT GAS-MANTLE.

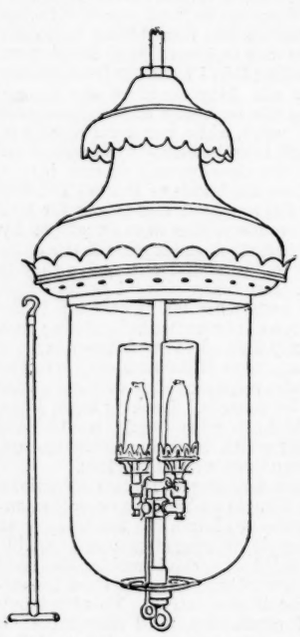
In the course of a lecture on this subject which he delivered lately at the Portsmouth Municipal Technical Institute, Professor Vivian B. Lewes traced the history of lighting by incandescence from the time of Goldsworthy Gurney's discovery of the lime light down to the present day, and dealt fully with the manufacture and compositions employed in the mantles of to-day. In treating of the theory of the causes of the high light-giving power of the mantle, he favoured the theory of Dr. Bunte rather than that which ascribed to the 99 per cent. thoria and 1 per cent. ceria mixture the special power of converting heat rays into light. Professor Lewes pointed out that, though attempts had been made to prove that there was a disappearance of heat during the period that the mantle was being heated, yet that no answer had been made to the experiments of Bunte and Swinton, which showed that the mantle mixture, when heated out of contact with air, emits practically no more light than other oxide mixtures which, when made into a mantle, have little or no power of light emission. In dealing with the present state of mantle manufacture, the causes of the power of keeping up their light shown by collodion and ramie mantles, were fully explained; and Professor Lewes stated that considerable improvements might be expected from the manufacture of the Plaissetty mantles, which were now being made by the Welsbach Company on a large scale at Wandsworth, while in cheap mantles many advantages were to be expected from the introduction into England of the Buhlmann processes of manufacture, now being installed in the East-end of London.

The lecture was illustrated by many experiments and some beautiful micro-photographic slides; and it was also rendered attractive by specimens of incandescent mantle lighting supplied by the Portsmouth Gas Company.

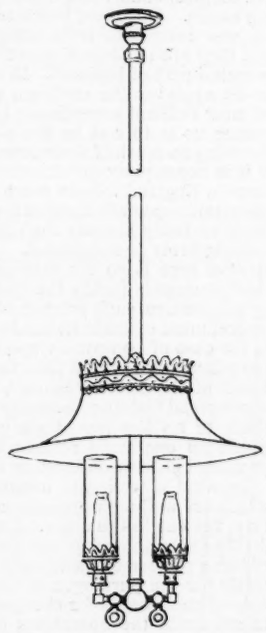
NEW FORMS OF THE "POND" LAMPS.

Quickly following their introduction of the "Wis" high-power lamp, Messrs. Pond and Co., of Farringdon Street, have enlarged the range of their productions. The remark we made in reference to the lamp with which the firm started business—to the effect that upon the design of the various parts practical minds had been at work—can be repeated in the case of the two additions. The first of the new lamps is described as the "Pond" patent arc gas-lamp, and the second as the "Wis" shade light.

In the first lamp, two points appear to have been kept prominently in mind—the first being convenience in both lighting and cleaning, and the second cheapness without going to such an extreme as to sacrifice strength. The top of the lamp is formed of solid copper, and is enamelled. In the illustration, although a deep cylindrical glass is shown, any form of suitable shaped globe, and of opal, half opal, or plain-glass, can be used. The globe is held in position by a strong nut at the base of the amp screwing on to the end of the supply-pipe, which is also



THE "POND" ARC LAMP.



"WIS" SHADE LIGHT.

provided with a ring on to which the ⊥ rod shown hooks for supporting the globe when cleaning is proceeding. Another feature about the lamp is that an exceedingly simply and ingenious arrangement permits of the use of any ordinary, instead of special burners, of the bye-pass type. In place of the lever-tap above the lamp, with the hanging and tempting operating chains, two (or any other number) burners of the usual kind, with the single-arm bye-pass tap, are used. The two arms engage in a slotted half-circle collar, which is operated by a small rod ending in a ring just outside the bottom of the lamp. This rod is retained by means of a spring in any position in which it is placed when the lamp is lighted; and it is worked up and down by the hook on the supporting rod previously referred to. It is a simple method of lighting lamps of the enclosed type.

In view of the illustration, little need be said about the "Wis" shade lamp. It is an eminently practical form for indoor use. It is light in appearance, and is fitted with an 18-inch shade, the shape of which produces a good diffusion of light in a manner which particularly meets the requirements of business establishments and shops.

Mr. G. B. Jackson, chemical manufacturer, of St. Anne's-on-the-Sea and Manchester, whose death was recorded in the "JOURNAL" for Nov. 24 last, left estate of the gross value of £14,461; the net personalty amounting to £12,059.

A MANTLE FACTORY IN BERLIN.

READERS of the "JOURNAL" have been made acquainted, through descriptive articles, with the processes associated with the manufacture of incandescent mantles as practised in this country; and some very interesting views have been published of the several departments in a large factory in which the operations are performed. Between the methods of one factory and another, controlled by individuals of different views and inclinations, there are found to be variations in method, though the final result may be approximately the same. We have seen these differences when visiting to the factories in this country; and they are found to be even more pronounced, in certain respects, in the factory to which attention is directed to-day. This is the new establishment in Berlin of the United Chemical Works (Messrs. Julius Norden and Co.), the makers of the well-known "Ino" series of mantles. This factory was only finished last year; and, as will be seen by fig. 1, it is a spacious place—possessing five storeys, and a top floor and basement. Taking the whole of the floors together, it is found that the building contains no less than 36,000 square feet of working and storage area. The premises are equipped for the production of 60,000 mantles per day; and as there are 600 girls employed in the various operations, the output averages 100 mantles per girl. It will be remarked from this that the operations are on an extensive scale.

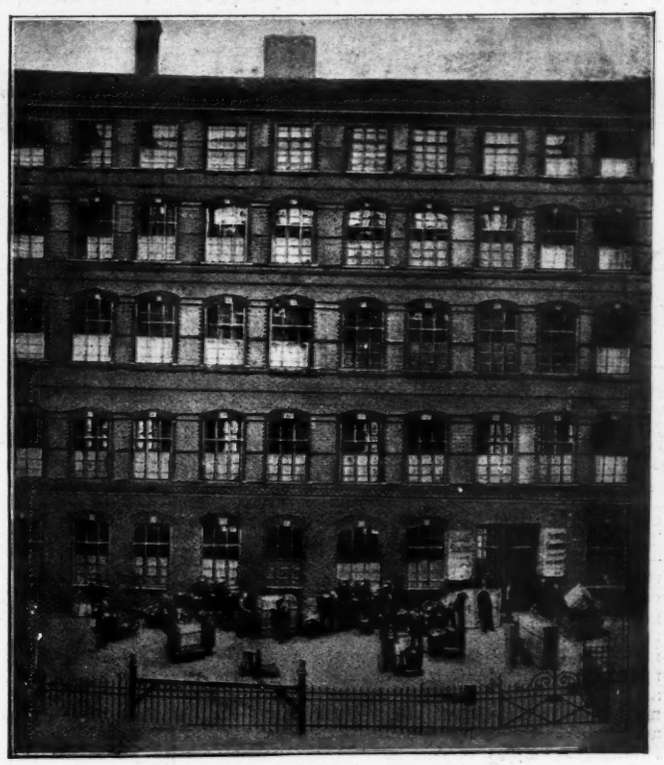


FIG. 1.—FRONT VIEW OF NEW FACTORY.

It is seen, in a run through the building, that Messrs. Julius Norden and Co. produce their mantles from the very start. In other words, they do their own spinning and knitting; and in the department devoted to this initial work (fig. 2), 172 knitting-machines are actively engaged, claiming the attention of some 30 employees. The length of mantle fabric turned out per day is about 20,000 yards, which (of course, all the figures given must be taken as merely approximate) is sufficient for the daily output of 60,000 mantles. This represents in the year the enormous production of above 6,000,000 yards of fabric, or about 3600 miles. This enormous turnout makes one wonder as to the extraordinary figures to which the total mantle manufacture of the world has risen since Welsbach's first great discovery. Speculation will not satisfy the wonder; and therefore it is better to pass on. In this spinning and knitting department, both cotton and ramie are worked up. The greater part of the cotton is bought in Manchester; and the last purchase of East India and Japan ramie was also made in this country. Previously, it was bought direct from British Colonies. The American cottons are not regarded favourably by the firm.

FIG. 2.—SPINNING AND KNITTING DEPARTMENT.

The fabric, which is woven into tubes, passes from the department just noticed to what is termed the chemical laundry (fig. 3), where it is treated in a centrifugal washing and rinsing machine. In this operation, distilled water only is employed, which is prepared within the factory. The machinery here is extensive, but only ten girls are required in the room; there being nothing more to attend to here than the mechanical washing of the fabrics. These are then raised by lifts to the drying hall (fig. 4), which is situated at the top of the factory. Two lifts, by the way, for the transference of the materials and mantles, run from top to bottom of the building; and in the subsequent operations it is almost a floor-to-floor descent to watch the course of the mantle from the first to the finished condition. This is an advantageous system of working in an extensive and high building such as this. However, the drying-hall just referred to is heated by steam-pipes to 32° C.; and the fabrics are left there to dry for the space of twenty-four hours. There is one other operation before the final treatment of the fabrics; and that is the cutting of the tubular material to the lengths necessary for the various sized mantles required (fig. 5). This is a convenient place to mention that, in this Berlin factory, about 25 different sized mantles are made—running from those suitable for "Gem" or Kern No. 2 burners up to the large sizes needed for Lucas or high-pressure lighting to the extraordinary ones used in the Denayrouze system. These Denayrouze mantles are no less than 9 inches long, and with a circumference of 6 inches; while the smallest ones are

FIG. 3.—CHEMICAL LAUNDRY.

FIG. 4.—DRYING-HALL.

only 2 inches long, with a circumference of 1 inch. The cutting-room is fitted with eight guillotines—such as book-binders use—for separating the fabric into the proper lengths. It would be quite easy to do the quantity of work to meet the needs of the other departments with three of these guillotines; but it is preferred to keep machines constantly regulated to the sizes of mantles for which there is the greatest demand, as this expedites the work. Hence the eight machines for doing the work that three could accomplish. In this room, there are from ten to twenty girls employed.

Following the fabrick to the impregnating-room, it is found that the system of treatment varies somewhat from the usual—the firm having for this work a capacious combined impregnating and drying machine (fig. 6). Inquiring first into the impregnating solution, the interesting information is given that a fairly considerable quantity of the thorium used in the making of the mantles is produced on the premises from mantle ash. Needless perhaps to say thorium sufficient for an output of 60,000 mantles per day is not procured in this way; and the balance is therefore purchased in the ordinary course from the German Thorium Syndicate. The thorium from the ash is produced in the firm's own laboratory, in which three chemists are constantly employed. But, when Mr. Norden mentions that from 1 lb. of mantle ash they get a yield of nearly 1¼ lbs. of thorium, one is at first sceptical, and wonders whether he knows that he has been mistaken in his measure of his hearer's credulity. But he explains, and does so satisfactorily. The mantle ash is treated with sulphuric acid, in order to convert the oxide of thorium into a sulphate. The sulphate is obtained in the form of crystals; and it is then converted into a nitrate in the ordinary way. The result is the remarkable one that more than 1 lb. of pure nitrate of thorium is obtained from 1 lb. of ash. The dealing in mantle ash appears to have become quite an important branch of the mantle business.

So much for this interesting fact connected with the production of the impregnating fluid. Before the firm adopted the large combined impregnating and drying machine shown in the illustration, hand impregnation and a dozen hand wringing-machines formed the method of working, and about twenty girls were engaged. Now, though a bigger business is done, four or five employees suffice, the work is accomplished much quicker, the impregnation is unquestionably uniform, and there is no loss of fluid. The machine is a gigantic thing. It is some 12 feet high, 30 feet deep from front to back, and about 6 feet wide, with glass doors in the front. The stockings are impregnated in front of the machine, and they then pass upwards in it, and finally out of the back in a perfectly dry state—they having passed, during their travel, through various degrees of temperature rising from 40° to 70° C. From the drying-machine, the mantles pass on to the sewing department, in which about 100 girls are employed in gathering together the heads of the stockings and fitting them

FIG. 5.—CUTTING-ROOM.

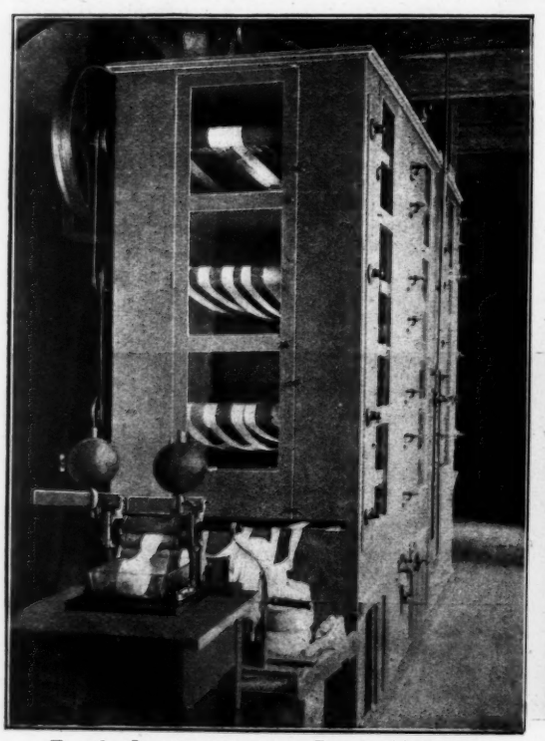


FIG. 6.—IMPREGNATING AND DRYING MACHINE.

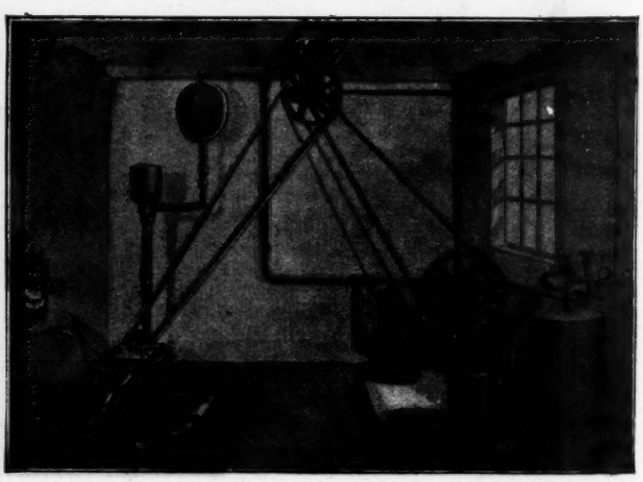


FIG. 7.—HIGH-PRESSURE GAS INSTALLATION FOR BURNING OFF.

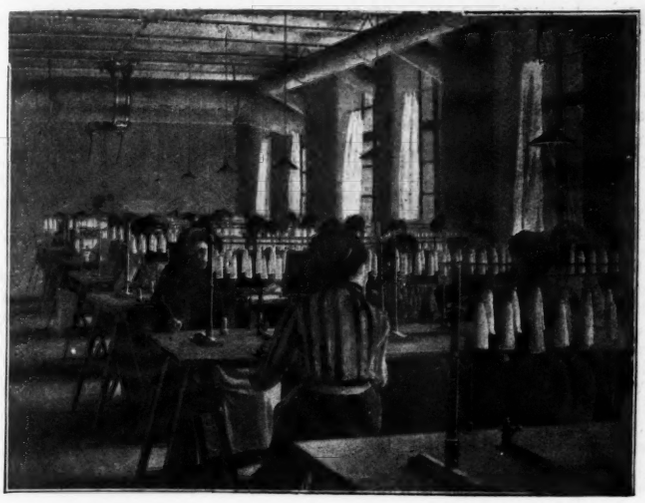


FIG. 8.—ONE PART OF BURNING-OFF ROOM.

with an asbestos loop. The shaping-room is the next stage in the perfecting of the mantles; and the name of the room sufficiently describes the operation performed in it. It requires a good deal of labour, though the work itself is of a simple character—some 60 to 70 girls being employed here, or (say) one to every three girls engaged in the burning-off department. Mention has been made in an earlier portion of the article of the variety of mantles the girls have to deal with in this room.

This brings us to the most important step in the work of mantle-making, and that is the process of burning-off. In fig. 7 is a view of the gas pressure-raising installation in the establishment for this particular purpose. The gas is raised to a pressure of about 10 inches; the pressure-increasing machines being driven by an electric motor. In the burning-off room (in which this high-pressure gas is supplied to each burner at constant pressure) about 200 girls are employed, each girl having only to give attention to a single burner (fig. 8). The firm prefer the individual treatment of the mantles in this important process; their experience, they say, with large machines burning off a number of mantles at a time, having been that such methods are not a success. But they are open to conviction, and make trials with any machine that appeals to them as worthy of notice. Just now an English engineer is superintending the installation at the factory of a burning-off machine to deal with a large number at a time; but the present style of working will continue to prevail over the new one until it proves itself to the firm to be the superior. Bearing in mind that there are 200 burners in use in this room, and 200 girls at work, the question of ventilation is, of course, a matter of great importance. An English system of mechanical ventilation is employed; and Mr. Norden gives the assurance that the system is so effective that the temperature of the burning-off room never exceeds that of the offices.

As the last was the most important stage in mantle making, so is the next one the most dangerous. This is the toughening and stiffening process; and a view of the room in which it is performed is given in fig. 9. Of course, the mantle as it leaves the burning-off room could be used straightway on a burner, but it could not be boxed and sent out in that condition to its ultimate destination. The mantles therefore go through the frequently explained operation of collodionizing—collodion being the well-known chemical product of gun cotton. The work therefore requires most scrupulous care; and the ventilation of the place is of the utmost importance. By mechanical means, the ingress and egress of air are considerable in volume, and constant. Large iron stoves fitted with asbestos plates, of the firm's own construction, are used for drying the mantles.

The subsequent work in finishing the mantles can be quickly disposed of. In the packing-room they are trimmed to the proper length, sorted, and packed ready for dispatch; and in this work something like 100 girls are engaged. In order to maintain an equality in the productions, photometrical observations are made day and night; a room being specially equipped for the purpose.

A little apart from the main building is the boiler-house (fig. 10), containing a boiler and an engine of 200-horse power, and a plant for generating electricity for power and lighting purposes. In the offices and the sewing department, gaslight is used; but in all rooms where there is any latent danger—such as the collodionizing room and the stores in which the fabrics are placed—there the electric light reigns.

In the basement of the building, there is a kitchen and also dining and cloak rooms for the girls, who in the meal intervals in their work are made as comfortable as is possible in a busy manufacturing establishment of this kind.

This sketch gives the reader a general view of the character and arrangement of this large mantle factory in Berlin, and of the methods there favoured in the process of mantle making. Of course, there are many small but interesting matters which cannot well be brought into the scope of an article of this kind. They can be seen by visitors better than they can be described in few words; and to see them, visitors to Berlin, it appears, will have little difficulty, if so disposed.

FIG. 9.—COLLODIONIZING-ROOM.

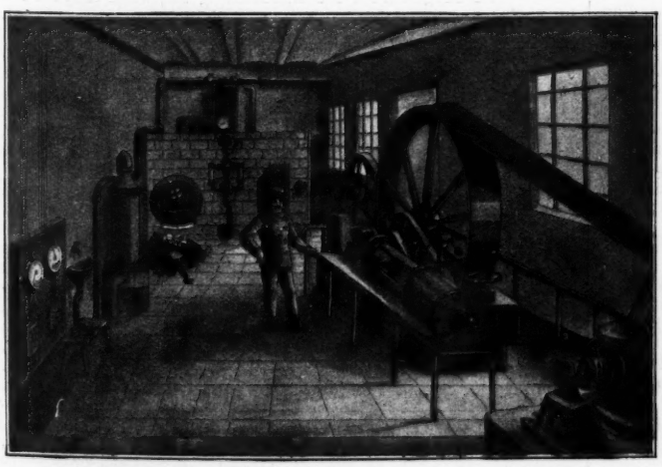


FIG. 10.—BOILER-HOUSE AND ELECTRICITY PLANT.

The London County Council and Gas and Meter Testing.—According to the accounts of the London County Council for the year ending March 31, 1903, which have lately been published, £3822 was spent in the twelve months on testing gas, and £7223 on testing meters. The revenue from these sources is included in an item of £15,286, which comprises petroleum, explosives, weights and measures, and other matters.

The Metric System.—The current number of the "Quarterly Review" contains an article on the metric system of weights and measures; and the writer examines exhaustively the arguments for its compulsory adoption. He comes to the conclusion "that the stock arguments of the advocates of the metric system, based on the extent to which it prevails abroad and the disadvantage to British trade of our adherence to a different system, have very little justification when we consider our whole trade, import and export, with our Colonies and with foreign countries." The "analysis of the conditions of our foreign trade," the writer states, "leads us back to the ground that the advocates of the change would do well never to have quitted—the comparative merits of the metric and imperial systems." He considers that "as regards all such important points as logical arrangement and symmetry, ease and swiftness of calculation, simple and direct connection among the fundamental units of length, weight, and volume, there can be no possible room for doubt as to the vast superiority of the metric system."

CAUSE OF EMISSION OF LIGHT BY FLAME.

The supplement to the "Scientific American" for the 9th inst. contains an article dealing with the development of the theory of the emission of light by flame; the author being Professor R. MONTGOMERY BIRD, Ph.D., of the University of the State of Missouri. The following extracts from the article present its most interesting features from our readers' point of view.

As one would naturally suppose, the theory now generally held regarding the nature of an ordinary flame and its power to emit light is not altogether the result of modern research, but has been evolved from very ancient and hazy notions. The best text-books and works on natural philosophy published near the end of the Eighteenth Century still used the terms "fire," "flame" and "light," with great looseness; and the conceptions of the material nature of flame and light were yet in their death struggles. After the corpuscular theory had given place to the wave theory, conflicting ideas arose as to why and how a flame emits light waves. When it was agreed that the waves were sent out by solid particles of carbon heated to incandescence, the question of the origin of the carbon, or the chemical changes taking place in the flame, was discussed, and along with this the source of heat which renders it incandescent. The last and most generally accepted answer to these two questions—the origin of carbon particles and the source of heat—is given in the "acetylene theory," first advanced in 1892 by Professor Vivian B. Lewes. This theory, expressed briefly, is that a portion of the hydrocarbon gas, by the heat of combustion of another portion, is converted into acetylene, and that this, on being decomposed by heat, furnishes the carbon particles which are rendered incandescent mainly by the heat liberated when the gas is decomposed; acetylene being a substance which absorbs heat during its formation, and hence liberates heat when it breaks down. Whatever is burned—whether a solid candle or liquid oil—must pass through the gaseous state; and hence this applies to all flames used for lighting purposes.

Among the first recorded experiments upon the nature and action of luminous flames are those which were carried out by Sir Robert Boyle between 1660 and 1670. He attempted to prove by experiment whether the light from a flame is like that from the sun, and corporeal, or whether it is merely a quality. He allowed a flame to play upon metals directly, and also when in open and sealed vessels; and because the substance formed a calx and gained in weight, he thought the light or flame (he uses the terms indiscriminately) had combined with the metal, and hence it must be a fluid. Boyle also conducted a large number of experiments upon live coals, phosphorescent bodies, animals, and insects, to see the effect of exhausting a receiver in which they were placed; and he seems to have concluded that the lights from live coals, decayed wood, and putrefying fish do not differ in kind but only in degree. He considered that the increase of light from coals, &c., and the reviving of certain insects when air was readmitted to the receiver, indicated a relation between a visible flame and the so-called "vital flame." But he would not commit himself upon the question of the supposed kinship between the "flame" from live coals and decayed wood and the "vital flame" thought to be burning in the hearts of living beings.

The interesting views of Sir Isaac Newton are set forth in a number of queries published in his work entitled "Optics." As is well known, Newton believed in the material nature of light; and he asserted that the change of light into matter and of matter into light is an acknowledged possibility and of common occurrence. He attributed the light which appears when a body is rapidly and repeatedly struck, or when it is heated beyond a certain point (as when flint and steel are struck together), to vibrations of the parts of the body so rapid as to throw off the particles which, according to his idea, occasion the sensation of light. With these he also classed electric sparks; saying that the "electric vapour" excited by rubbing glass against a strip of paper, or the end of the finger held to it, is thereby so agitated as to cause it to emit light. With regard to true luminous flames, however, his ideas were nearer those of the present time.

During the hundred years, more or less, following the publication of Newton's views, there was little change in the prevailing theories. Stahl said that flame was light liberated from bodies in the act of combustion, and that light and heat were the constant attendants of fire. Fire combined with combustible matter was "phlogiston." Scheele said light, heat, and fire were combinations of air and "phlogiston." Lavoisier thought flame to be light disengaged from air, with which it had been in combination; and this idea seems to have been adopted by most of the French chemists.

At a single step we pass from the rather crude ideas of the older thinkers to those which obtain at the present day; and the transition finds little expression in the literature. About the year 1816, Sir Humphry Davy advanced what has been known ever since as the "solid particle" theory of luminosity—a theory which went unchallenged for 45 years, and was accepted by practically everyone. He was experimenting upon the combustion taking place in his famous safety lamp, and said:

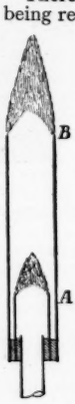
I was led to imagine that the cause of the superiority of the light of a stream of coal gas might be owing to the decomposition of a part of the gas towards the interior of the flame, where the air is in smallest quantity, and the decomposition of solid charcoal, which, first by its ignition, and afterwards by its combustion, increased to a high degree the intensity of the light; and a few experiments soon convinced me that this was the true solution of the problem. . . . Whenever a flame is remarkably brilliant and dense, it may always be concluded that some solid matter is produced in it. On the contrary, whenever a flame is extremely feeble and transparent, it may be inferred that no solid matter is formed.

The idea that solid carbon in the flame is the source of its light was not original with Davy—he says, indeed, it was suggested by a Mr. Hare. But it was Davy's investigations which put it on a firm basis; and he formulated the theory.

Davy showed the relation between the heat and the light of flames, the effects of rarefaction and compression of the surrounding air, and the influence of cooling and heating. He pointed out also that a luminous flame will deposit carbon on a cold surface, and if rendered non-luminous no carbon can be obtained. These conclusions were immediately accepted, and were not seriously disputed until the appearance in 1861 of a communication to the Royal Society from Edward Frankland, in which he advanced what has come to be known as the "dense vapour" theory. He and his adherents claimed that, though solid particles in a flame cause it to emit light, the light from ordinary illuminating flames is dependent to a great extent upon the presence of dense transparent hydrocarbon vapours from which it is radiated, and is not due to the presence of incandescent solid carbon particles. They further claimed that the soot deposited is not carbon, but a mixture of dense hydrocarbons of remarkably high boiling points.

Since the publication of Frankland's views, a great deal has been done by Heumann, Stein, Smithells, Burch, Lewes, and others. Stein disproved Frankland's assertion that soot is a mixture of dense hydrocarbons, by showing that it cannot be volatilized even by great heat, and that it contains only about nine-tenths of 1 per cent. of hydrogen, which can be separated from it only at high temperatures in an atmosphere of chlorine. Nor did Frankland's view, that glowing dense vapours cause the light, appeal to Heumann, who thought it unlikely that these should exist in a flame, or that there is a sufficiently high temperature to cause them to glow. Frankland said that flames cannot contain solid particles because they are transparent. Heumann pointed out that thick flames are opaque, and that thin ones are no more transparent than is an equal layer of soot rising from burning turpentine—the rapidity of the motion of the particles preventing any obstruction to the view, just as is the case with a rapidly revolving spoked wheel. Burch found that, when sunlight is reflected from a luminous flame, it is polarized; while if it is reflected by glowing vapours, however dense, it does not exhibit this phenomenon. All of Burch's work was confirmed by Stokes some years later.

There was now left no shadow of doubt whatsoever about carbon being really and truly the source of the light rays; and the next question that concerned investigators was the chemical changes which give rise to carbon particles. In the study of these, a flame burning at a round hole offered the best conditions. As explained in text-books on chemistry, such a flame might be thought of as being made up of an inner faintly luminous cone fitting into an outer one, brightly luminous; the latter being surrounded by a non-luminous sheath of water vapour and carbon dioxide. It was desirable to separate these two cones, in order to study the gas after it had left the inner one and before any change had been brought about by the conditions existing in the outer one. This separation was first accomplished by Teclu in France and Arthur Smithells in England, working independently, with a piece of apparatus of which the essential features are shown in cross-section in the figure. By a proper control of the relative proportion of gas and air, the inner cone was made to burn at the orifice A, while the outer cone burned at B. The outer cone obtained its oxygen from the surrounding air, while that for the lower flame was supplied with the gas. The temperature of each cone was measured, and the gases entering and leaving each were analyzed. It was found that as the proportion of gas to air was increased, the tip of the inner or lower cone became brightly luminous, and a column of soot passed upward through the tube, becoming faintly luminous in the outer edge of the upper flame. As soon as the inner cone becomes luminous, the unsaturated hydrocarbon compound known as acetylene begins to appear among the gases passing to the outer cone.



Professor Lewes now attacked the problem as to how carbon comes to be in the flame in the free state. He analyzed gas drawn from different parts of a coal-gas flame, measured the temperature of its different parts, &c., and published his results between 1892 and 1895* These results may be stated as follows: Coal gas consists mainly of a mixture of hydrogen and hydrocarbons, both saturated and unsaturated. In an ordinary fishtail burner flame, all hydrogen is consumed before the middle of the luminous portion is reached. Of the saturated hydrocarbons, about 75 per cent. disappear as such in the dark portion and about 24 per cent. are lost in the lower half of the luminous part.

* Detailed accounts of the experiments here referred to, as well as of those of Professor Smithells, will be found in the "JOURNAL." See Vol. LIX., pp. 68, 795; Vol. LXII., pp. 582, 722; Vol. LXV., p. 796; and Vol. LXVII., pp. 276, 747, 807.

In the dark part there occurs a transformation of saturated into unsaturated hydrocarbons, along with a general breaking-down of all to yield products less rich in hydrogen and the oxides of carbon. At the point where luminosity just begins, from 70 to 80 per cent. of the unsaturated compounds are acetylene, though less than 1 per cent. was originally present. No acetylene could be found in the flame when it was made non-luminous.

By causing pure gases to pass through tubes heated to known temperatures, and analyzing the products formed, he studied the effects of heat upon both saturated and unsaturated hydrocarbons. At 800° C., an unsaturated compound, like ethylene (C_2H_4) breaks down into hydrogen and the still more unsaturated acetylene (C_2H_2). At 1200° C., the very stable saturated hydrocarbons decompose into acetylene and hydrogen, and the acetylene in turn decomposes into carbon and hydrogen. Even very dense hydrocarbons decompose at the temperature named. These results strengthened Professor Lewes's conviction that, under the baking action of the flame walls in the lower portions, acetylene is produced in relatively large quantities, and that this is the source of the carbon.

The question which immediately presented itself was: Does there exist in an ordinary flame such conditions of temperature as may bring about the formation of acetylene from the very stable constituents of the illuminants? On measuring the temperatures at various places, the necessary temperatures were found to exist. The work was complete and conclusive, and forced a general acceptance of the theory that acetylene is the immediate source of the carbon. But a yet harder problem presented itself. What gives rise to heat sufficient to make the carbon become incandescent?—a burning question certainly, and one not easy to answer. From the time of Davy till the year 1892, the only opinion was that the burning hydrogen, carbon monoxide, and hydrocarbons furnished the heat necessary to raise carbon to incandescence. In that year, however, Professor Lewes advanced his "latent heat" theory, which declared that the latent heat set free when acetylene is decomposed instantly heats to incandescence the carbon particles thus set free.

Professor Lewes sums up his conclusions, drawn from all his work, somewhat as follows: When the hydrocarbon gas leaves the jet at which it is burned, those portions which come in contact with the air are consumed, and form a wall of flame, which surrounds the issuing gases. The unburnt gas, in its passage through the lower heated area, undergoes a number of chemical changes, brought about by the heat radiated from the flame walls; the principal change being the conversion of hydrocarbons into acetylene, hydrogen, and methane. The temperature of the flame rapidly increases with the distance from the jet, and reaches a point at which it is high enough to decompose acetylene into carbon and hydrogen with a rapidity almost equal to that of an explosion. The latent heat so suddenly set free is localized by the proximity of carbon particles, which, by absorbing it, become incandescent, and emit the larger part of the light given out by the flame, though the heat of combustion causes them to glow somewhat until they come into contact with oxygen and are consumed. This external heating gives rise to little of the light.

There have been opponents to this theory of the cause of luminosity, as there are, fortunately, of all theories; but the evidence is so strong and covers so many points, and so many investigators have confirmed one part or another of the work, that it has been generally accepted as a true statement of the facts with which it deals.

CALORIMETRIC TESTS OF COALS.

At a recent Meeting of the London Section of the Society of Chemical Industry, a paper was submitted by Messrs. J. S. S. Brame and Wallace A. Cowan, of the Royal Naval College, Greenwich, in which they gave an interesting account of some experiments they had made with different types of calorimeters in the testing of coals. The paper has been reprinted from the Society's "Journal," and the authors have sent us a copy, from which we make the following extracts.

The question of the calorific power of fuels in relation to boiler economy and other engineering problems has given rise during the last twenty years to the introduction of a large number of calorimeters, for each of which some special advantage has been claimed. Of these various forms there are but few in general use; and the differences between the results obtained with these instruments seriously militate against any great confidence being placed in such determinations. It is, therefore, of importance to ascertain exactly how the results obtained with a particular type of calorimeter will compare with those determined with another form, which may be very different in principle. The importance of a proper comparison has been recognized by Kent, who stated that "the variations in the calorimetric tests of coal throw doubt upon all calorimetric work until a sufficient number of tests shall have been made by different experimenters and with different calorimeters upon similar samples, and until tests so made show a reasonable degree of uniformity."

In view of the great differences which have been observed, and the extreme importance of the matter from an industrial point, the authors, at the suggestion of Professor Lewes, undertook the investigation of some selected coals with typical calorimeters, and carried out the work in as careful a manner as possible, so that from a large number of experiments reliable data might be obtained, not only between one calorimeter and another, but also on the limit of error which might be expected when a series of experiments were made with the same coal in the same instrument.

Starting from an anthracite, the experiments were made with five coals with gradually increasing amounts of volatile matter. The calorimeters were the more commonly used representatives of certain types—

1.—Where combustion is effected by admixture with a solid oxidizing agent (Lewis Thompson).
2.—Combustion with oxygen gas at constant pressure: (*a*) Where the temperature of the escaping gases is undetermined (William Thomson); and (*b*) where it is under control (F. Fischer).
3.—Combustion with oxygen at constant volume (Mahler's bomb).

Several hundred grammes of each coal were crushed and thoroughly mixed, and then some 200 grammes further reduced until it all passed through a 30-mesh sieve. In order that variations in the moisture should not interfere with the determinations, the coal was always used after drying at 100° C. A careful ultimate and proximate analysis was made of each sample.

The Lewis Thompson Calorimeter.—This instrument is too well known to need any description, and it is probably more often employed than any calorimeter, since it is cheap, and experiments are easily conducted even by an unskilled person. It has long been recognized that the results obtained are but approximations to the truth; and the unscientific addition of 10 per cent. for losses should at once condemn it. Nevertheless, it is contended that it gives comparative results of a satisfactory character. This, however, as will be seen from the figures given, can only apply with coals of a very similar nature. Mr. J. W. Thomas has given much valuable information as to the use of this instrument.* His results show that the more bituminous a coal is, the better are the results; and, further, that when a coal does not yield more than 86 per cent. of coke, full values are obtained. With anthracite, dry steam, and bastard anthracites, the results were unsatisfactory. Thomas does not appear to have estimated the unburnt coal.

In working with the instrument, the authors adopted the recommendations of Thomas; the coal being sieved through a 60-mesh sieve, and the chlorate-nitrate mixture through one of 30 meshes. In every case the amount of unburnt coal was determined by evaporating down the water and washings from the calorimeter with hydrochloric acid, taking up the residue with acid water, filtering through asbestos on a Gooch filter, which was then washed, dried, and weighed. The crucible was heated in a muffle till all carbonaceous material was burnt, and the loss of weight taken as unburnt coal. Two gauze discs were fixed on the bell of the instrument (as in W. Thomson's calorimeter), and were found to be very successful in breaking up the large gas bubbles and giving better results generally. This modification was adopted for all the experiments recorded later.

The William Thomson Calorimeter.—With this instrument the oxygen was obtained from a cylinder; but in view of incomplete combustion said to result from the gas being too dry, it was first passed through a Muencke's wash-bottle containing water, and then through a calcium chloride tower filled with thoroughly moistened pumice. The water value of the instrument was determined by weighing the parts and calculating from the specific heats; experimental controls being made with known weights of warm water. In all the experiments the water (2000 grammes) was weighed out. The results were corrected for losses by radiation taking place during the experiment.

The Fischer Calorimeter.—In this instrument the coal is burnt in the form of a pastille in a small platinum gauze basket. The products of combustion are cooled in a special chamber, and led out by a wide metal tube. A thermometer in this tube enables the rate of combustion to be so regulated that no loss of heat occurs through the gaseous products. Fischer states that the issuing gases when charcoal was used show both carbon monoxide and hydrogen; so that combustion is not perfect. In our experiments, a thin smoke was always observed. The oxygen used was rendered moist by passing through the wash-bottle and tower previously mentioned. For the experiments 1500 grammes of water were weighed out, and the water value of the instrument taken into account. The coal was ignited electrically. The results were corrected for losses by radiation.

The Mahler Bomb Calorimeter.—The water value was determined from the specific heats of the various parts, and was checked by determinations with naphthalene which yielded results in close agreement with Berthelot's. The amount of water weighed into the calorimeter vessel was 2450 or 2448 grammes, according to the thermometer employed; thus giving a convenient factor (3000) for the calculation of results. The correction for cooling used was the simple one which Mahler recommended, based on Newton's law; this being sufficiently accurate for almost all calorimetric work where the time between the ignition and the maximum temperature is small.

The correction for nitric acid formed was obtained by titrating

* See "Chemical News" for 1881, p. 135.

the washings from the bomb with standard sodium carbonate (3·706 grammes per litre). Each cubic centimetre of this solution represents 1 calorie in the correction. Ignition of the coal was made by means of fine platinum wire, so that no further correction was necessary.

A summary of the results obtained in the experiments is given in the following table:—

CALORIMETER EMPLOYED.

Coal.	Lewis Thompson (Corrected).	William Thomson.	Fischer.	Mahler.
A.—Mean	8418·0 (8)	8284·0	8139·00	8629·00 (3)
Highest	8602·0	8490·0	8172·50	8639·00
Lowest.	8082·0	8129·0	8090·00	8613·00
Per cent. error	6·4	4·4	1·00	0·30
B.—Mean	7235·0 (7)	7178·0	7509·00	7713·00 (3)
Highest	7436·0	7303·5	7561·00	7727·00
Lowest.	7029·0	7090·5	7465·50	7706·00
Per cent. error	5·8	3·0	1·27	0·27
C.—Mean	8331·0	8324·0 (7)	8243·00	8617·00 (3)
Highest	8442·5	8425·0	8287·50	8631·00
Lowest.	8173·0	8162·0	8187·00	8606·00
Per cent. error	3·1	3·2	1·20	0·30
D.—Mean	8144·0	8233·0	8049·70	8394·50 (3)
Highest	8250·0	8304·0	8087·50	8402·50
Lowest.	8063·0	8156·0	8007·50	8389·00
Per cent. error	2·3	1·8	1·00	0·16
E.—Mean	8178·0	7882·0 (8)	7627·00	8026·50 (3)
Highest	8316·0	7997·0	7648·00	8037·00
Lowest.	7997·0	7755·0	7598·00	8018·00
Per cent. error	3·9	3·1	0·60	0·24

The figures in brackets show the number of experiments from which the mean was obtained. When no figures are given, the number of experiments was six.

The Lewis Thompson Calorimeter.—The recognized deficiencies of this much-used instrument have already been alluded to; and although a great deal has been written on the subject, no information has hitherto been available, so far as the authors can find, on the actual amount of coal which escapes combustion. If a charge be fired in a crucible in the open air, particles of ignited coal are thrown up to a height of several inches. Clearly, if the bell were over the crucible, such particles would be thrown back and extinguished. That the amount of unburnt coal largely depends on the proportion of oxidizing material employed—in fact, is roughly proportional to it—is well shown with the four coals A, B, C, D, in which the ratio was varied. Thomas (*loc. sit.*) states that "the quantity which appears to be best adapted is not that which always gives the most trustworthy results." That this is due to the unburnt coal is clear, for the mixture which burns most vigorously is invariably that in which a high ratio of coal is employed, and which gives the greatest amount of unburnt coal. It would appear desirable, therefore, to use as large an amount of chlorate mixture as possible; but a practical limit is soon reached, for with the high proportions the combustion is very difficult to start, and more frequently than not the charge goes out, apparently owing to the mass of fused chloride, &c., in the crucible. The instruction often given to first find out the proportions in which the mixture burns most readily and then adopt them is therefore misleading.

It was assumed, in making the correction for the unburnt coal, that its calorific value would be the same as that of the burnt coal. But there is little doubt that such is not the case with a coal containing much volatile matter, for at the temperature in the crucible, the hydrocarbons would practically all be distilled out and burnt; so that it would probably be more correct to take the unburnt coal as determined, and apportion to it a calorific value nearer to that of charcoal. That the correction in the above form is not satisfactory is evident from the results with coal E, where the mean result is actually higher than the bomb determination. Generally speaking, the corrected results agree fairly well with those obtained with the William Thomson and Fischer instruments (except E). But the estimation of the unburnt coal is so tedious an operation, and one which would be seldom carried out in practice, that most observers would rely on the uncorrected figure; and this would be so far from the truth, except with a highly bituminous coal, as to be quite valueless.

The William Thomson Calorimeter.—The results obtained with this instrument were certainly disappointing; the limit of error for a particular coal being higher than we anticipated. It will be seen, however, that the mean results more closely follow those obtained in the bomb than do the mean results with the other instruments. The possible sources of error may be (*a*) error in the thermometer reading, (*b*) incomplete combustion of the coal in the crucible itself, (*c*) escape of products of combustion at a higher temperature than the water, or (*d*) loss by the gases themselves, due to carbon monoxide, smoke, &c. This latter probably leads to the greatest error, for, however carefully the experiments were conducted, there was always more or less thin smoke at the top of the jar. The results of our experiments have an important bearing on the work of Adams, * where he claims to have shown that oxygen direct from the cylinder gave lower results than when the oxygen was saturated with aqueous vapour.

The Fischer Calorimeter.—This instrument gave very concordant results with each coal individually—the experimental error only amounting on the average to about 1 per cent.; but the mean results as compared with the bomb were disappointing. In four cases they were the lowest obtained with either instrument, and differed considerably from the correct value. Coal B was, however, an exception, and it gave a mean result which was higher than the means from either the Lewis Thompson or the William Thomson calorimeter. On the five coals examined, the average error, as compared with the bomb, amounted to some 4 per cent. A curious result, and one for which we have not found a satisfactory explanation, was repeatedly observed during the experiments. By allowing the oxygen to pass through slowly, the thermometer which indicated the temperature of the escaping gases could easily be made to register nearly a degree lower than the temperature of the water in the calorimeter.

The Mahler Bomb Calorimeter.—This gave most satisfactory results; and, seeing the close agreement obtained, it was unnecessary to make more than three determinations with each coal. The greatest difference between any two results with the same coal was 26 calories.

General Conclusions.—The Lewis Thompson calorimeter is the only one in general use relying on a solid oxidizing material; and with this instrument the experimental error is very large. For bituminous coals, it might give a rough comparison; but in every case the amount of unburnt coal should be determined. Such determinations are laborious, and far exceed the trouble of arriving at a correct result with a bomb calorimeter. The experimental error with a William Thomson calorimeter is also high; and while the Fischer calorimeter gives concordant results for the same coal, they are far from the truth. There seems no reason to suppose that other calorimeters of either of these types should give much better results, for in every case of burning coal with oxygen under atmospheric pressure there is the trouble of incomplete combustion.

The conclusion arrived at by all who have had experience with some form of bomb calorimeter as to its marked superiority is amply confirmed by our results. The only objection to its use is the question of expense. It is easy to manipulate, when once the details have been mastered; and determination can be made with fair rapidity. It is not, however, an instrument suited to the rough-and-ready methods of an engineering shop. Calorimetric results are of little value unless they are fairly accurate; and the requisite degree of accuracy can only be arrived at when perfect combustion can be assured, as in the bomb.

Calculation of Results from Ultimate Analyses.—This question has been frequently discussed, and has given rise to contradictory opinions. From the results stated in this paper, it is clear that a comparison can only be obtained with determinations made with a bomb calorimeter; or, if with some form of instrument where combustion takes place at ordinary pressures, the products of combustion are analyzed and corrections made for unburnt gases. Even when so corrected, the results are not perfect, for several reasons; and Scheurer-Kestner has shown that the bomb method gives from 1 to 3 per cent. lower results than the corrected Favre and Silbermann calorimeter.

Mahler, in his exhaustive research, gives calculated and determined values for a large number of coals; the extreme calculated values relatively to the determined values on the coal dry and free from ash for the different classes being—

	Calories.
Anthracites	+ 206 — 123
Fat and semi-fat	+ 95 — 285
Fat gas coals	+ 286 — 191
Flaming coals (lignitic)	+ 24 — 199

Lord and Haas found a close agreement between the calculated and determined values for some forty coals—there being only a maximum difference of 2 per cent., and a minimum of 0·1 per cent.; and they conclude that "it seems certainly possible that the differences between calculated and observed values are within the limits of experimental error." Lord, however, in the case of five other coals, found a good agreement in three cases; but with the other two specimens, the calculated values were 2·7 and 3·1 per cent. low respectively. Lord suggested that this might be due to errors in analysis arising from unburnt carbon. Clearly, the boat and the ash could not have been heated after the first weighing had taken place to ensure that no further loss took place—a precaution which should always be taken when dealing with coals.

Analyses of Coals (Dry) and Calculated Values.

Formula for calculated values: $Q = \frac{1}{100}\left[8140\,C + 34{,}500\left(H - \frac{(O + N) - 1}{8}\right) + 2220\,S\right]$.

Coal.	C.	H.	S.	Ash.	O. + N.
A	90·09	3·85	0·770	1·68	3·610
B	81·02	3·23	0·640	9·50	5·610
C	87·79	4·09	0·590	3·14	4·390
D	84·07	4·51	0·685	5·69	5·045
E	78·29	4·76	1·480	4·90	10·570

* Recorded in the Society's "Journal" for 1901, p. 972.

—	Fixed Carbon.	Volatile Matter.	Calorific Values.		Per Cent. Low of Calculated.
			Calculated.	Determined.	
A.	91·48	6·84	8567	8629·0	0·7
B.	80·80	9·70	7527	7713·0	2·4
C.	82·79	14·08	8425	8617·0	2·2
D.	73·81	20·50	8241	8394·5	1·8
E.	61·10	34·00	7638	8026·5	4·8

From the results given in this paper, it will be seen that with two of the coals (B and C) the calculated values are more than 2 per cent. lower than the determined; and with coal E, this difference amounted to little less than 5 per cent. There is no reason to doubt the analytical results, since they are the mean of duplicates in good agreement. The result with coal E may in a large measure be due to the somewhat exceptional nature of the coal, containing as it does 10·57 oxygen + nitrogen. Mahler recognized that the ordinary Dulong formula is not satisfactory when the oxygen and nitrogen are high, and proposed a formula—

$$Q = 1\tfrac{1}{100}\,[814\,C + 34{,}500\,H - 3000\,(O + N)].$$

It is impossible to generalize on the few experiments with individual coals which have been made by the authors; but, taking everything into consideration, there does not at present appear to be that close agreement between calculated and the determined values in certain forms of bomb calorimeter which some writers have claimed. That a fairly close agreement exists with a large number of coals may be granted. But exceptional cases arise; and these, being always liable to occur, make calculated results of doubtful value. It is only because of the renewed interest in the question which has arisen since the introduction of the bomb calorimeter that the matter has become of importance; for there is every reason to neglect the older controversy on this relationship because of the doubtful accuracy of many of the calorimeter determinations with which comparisons were made.

FLAME TEMPERATURE AND ITS MEASUREMENT.

The importance of the actual temperature attained by a gas-flame in relation to the luminous effect produced by it either directly or indirectly through heating an incandescent mantle, is so well understood, that much experimental work has been done with the object of measuring this temperature. Many results so obtained have been published; the measurements being made in every case by some form of pyrometer. Such determinations are all open to the criticism that the mass of the measuring instrument itself is competent to disturb the action of a flame, especially when it is known that the different coats of a flame in which the phenomena of combustion are being produced are of extreme thinness and delicacy. This consideration seems to have weighed greatly with M. Féry, whose investigation of the subject led him to the conclusion (reported in the "Comptes Rendus") that no measurement of the temperature of a flame which involves the introduction into it of solid matter to be heated can be accurate, on account of the disturbance of the combustion and the abstraction of heat thus caused. This experimenter therefore undertook the measurement of the temperature of flames by a new method free from this objection, which depended upon observation of the momentary reversal of a sodium line in the flame by the light of a carbon incandescent lamp which could be gradually raised in temperature by increasing the current through it. The latter had been previously calibrated. Assuming the correctness of M. Féry's work, his determinations are as follows:—

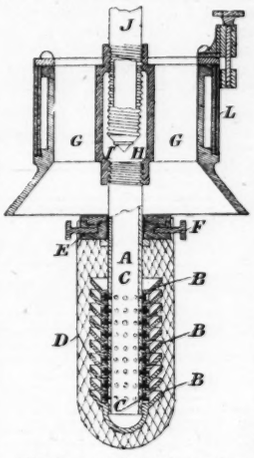
	Deg. C.
Bunsen burner, gas fully aerated	1871
,, ,, insufficient air	1712
Acetylene flame.	2548
Alcohol flame	1705
Denayrouze bunsen, alcohol and air	1862
,, ,, half each alcohol and petroleum spirit	2053
Hydrogen, free flame in air	1900
Oxy-coal gas blowpipe flame.	2200
Oxy-hydrogen ,, ,, ...	2420

Dividend of the Gaslight and Coke Company.—We are informed by the Secretary of the Company, Mr. H. Rayner, that the accounts for the past half year show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £175,417 5s. This result compares with a dividend at the same rate for the half year ending Dec. 31, 1902, and a balance carried forward of £65,146 19s. 4d.; and also with one at a like rate for the six months ending June, 1903, but with a carry-forward then of £116,530.

REGISTER OF PATENTS.

Gas Burners and Mantles.—Helps, G., of Nuneaton. No. 1543, Jan. 22, 1903.

This invention refers to burners the heads of which are inserted into the mantle to a considerable extent—thus shaping the flame (by divisions, feathers, or deflecting projections) to the mantle on the side in contact with the mantle as well as on the burner side. The invention is applicable to vertical as well as to inverted burners; and the burners take a variety of forms.



One form is where a round burner tube has a series of rings of holes at any desired pitch throughout its length. A feather, division, or projection, set at any angle, is introduced between each set of holes; and the rings are so formed that there is a gas-way in them connecting the mixture of gas and air in the round burner tube with another series of holes in the rings. In place of the holes, the edges of the rings may be serrated or slotted; and in place of the burner ring containing the gas-way connecting the holes in the ring with the inner tube, the inner tube may contain the gas-way. Or the burner may be constructed so that there is an annular or other space between the inner tube and the special rings, and communication made between the inner tube and the annular space.

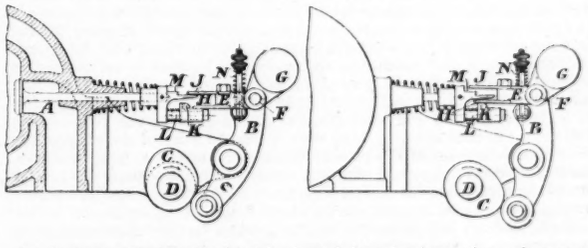
The inner tubes take various forms; and they may be used to regulate the supply of gas to any particular ring of holes. This may be accomplished by so shaping the inner tubes that the mixture of gas and air can only be supplied to any particular ring of holes through certain holes or slots of any required size in the inner tube itself. The inner tubes may also be used to increase the distance that the mixture of gas and air has to travel, and "so promote an intimate admixture of gas and air and prevent lighting-back."

A section is given of an inverted burner attached to a special casing. A is the inner tube, with rings of holes connecting with the burner rings B; C is the gas-way in the burner rings; D, the mantle; E, the mantle-holder; and F, the pins passing through loops on the mantle. G is the vertical exit for the combusted gases; H, the inlet for atmospheric air; I, the gas-nipple; J, the main gas-supply tube; and L, the hit-and-miss slides for regulating the air supply to the passage H.

Internal Combustion Engines.—Crossley, W. J., of Manchester, and Webb, W. le P., of Marple. No. 4510; Feb. 26, 1903.

This invention refers to the regulating of the speed of internal combustion engines by means of hit-and-miss governors, which operate in such a manner that the knife edges (or their equivalent) of the governor are only called upon to lift or move light parts into such positions that they either make a gap or fill a gap in the train of gear which is used to operate the valve or other part of it to be governed—the knife edges not being called upon to directly lift or move the valve itself.

In patent No. 8704 of 1902, several methods of applying this system of governing were described. The object of the present invention is to obtain similar results by the use of fewer parts and by means of only one reciprocating lever or other similar part; the patentees claiming that they are enabled to operate both the knife-edged governing parts and the valves or other parts which are to be governed. In order to effect this result, the forward movement of the lever is divided into two portions; the first being utilized for determining (in conjunction with the governor) whether the valve is to be opened or not, and the second portion to actually open the valve when required.



A suitable method is illustrated of applying the invention when an inertia governor is used. The valve to be opened is shown at A. The lever B is given a reciprocating motion by the cam C, which is revolved by the shaft D. A pusher-block is shown at E, which is pivoted at F; and on this pusher-block are fixed the weight G, the governing blade H, and the pusher J. When the speed of the engine is at or under the normal, the knife edge of the governing blade, in moving forward, engages with the notch of the die K, which then slides forward on the pin L until the pusher comes in contact with the valve spindle-block M and opens the valve. When, however, the speed of the engine rises above the normal, the weight G, owing to its inertia, overcomes the resistance of the spring N, and tends to hang back when the lever B moves forward. The result is that the knife edge of the governing blade H rises above the knife-edged notch of the sliding die K; and owing to the slope of the upper part of the die, the governing blade is further raised (together with the pusher J), so

that on its further motion forward the pusher is clear of the valve spindle-block M, and the valve is therefore not opened. The gear is shown in this position in the second sketch.

Retort-Charging Apparatus.—Bronder, G. A., of New York. No. 28,813; Dec. 30, 1902.

The patentee claims as the primary object of his invention the production of means by which coal can be fed into retorts so as to pile it in thick layers at the sides, in order to secure a uniform carbonization and leave a channel through the coal parallel to the longitudinal axis of the retort for the exit of the gases generated. A further object is "to produce apparatus of such form and construction that it will deposit sufficient charges of coal into the retorts to obtain the largest capacity of charging apparatus applicable to the respective retorts, with the maximum efficiency."

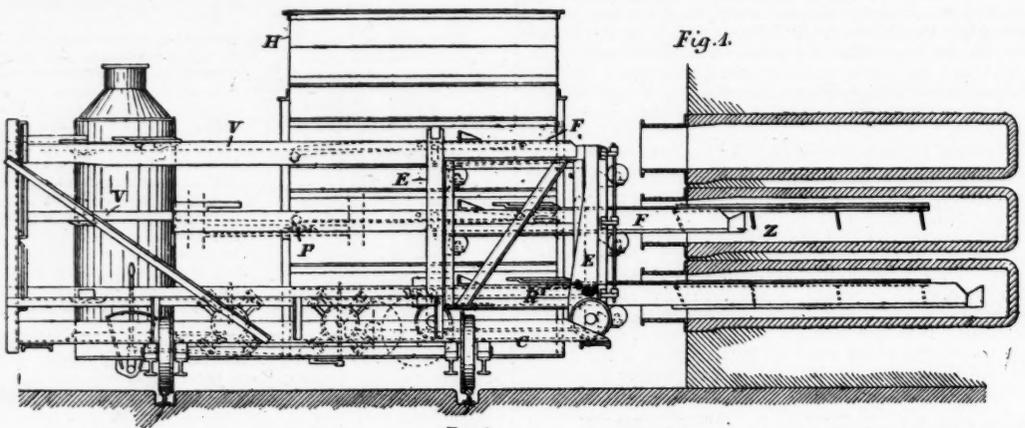


Fig. 1.

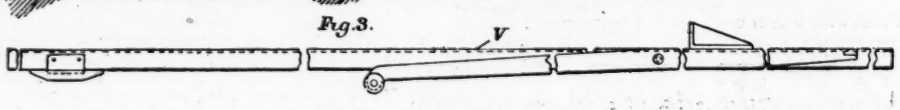


Fig. 3.

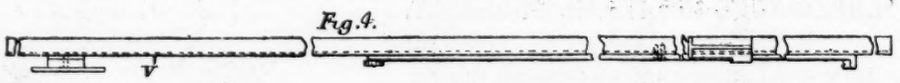


Fig. 4.

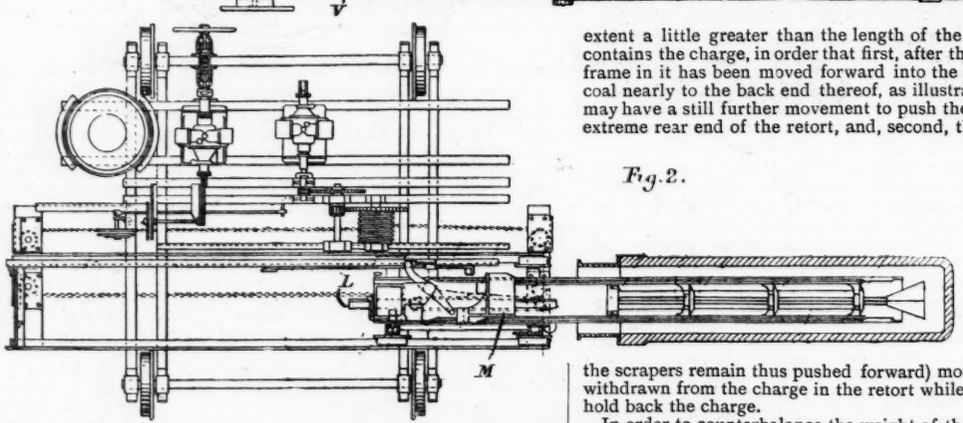


Fig. 2.

With these objects in view, the "organization" of the invention is said to comprise: Scoops provided with scraper-frames from which are pivoted scrapers that project into, and extend approximately to, the bottom of each scoop, with one scraper secured to each of the frames without pivots, and extending to nearly the bottom of its respective scoop; a lifting plough secured to each scoop, projecting into, and extending beyond, it, and by means of which latter the coal is lifted as it leaves the scoop and then directed to the sides of the retorts—the lifting of the coal allowing it to slide down the sides of the plough and pile up at the sides of the retort; flexible connected covers, retainers, doors, or slides connected with the scrapers to allow each scoop with its plough to pass the scrapers when it is receding from its scraper-frame to empty its charge into its retort; also a locking device for the scoops, and an improvement in the mechanism for accelerating the movements of the scraper-frames, with their scrapers, beyond the position of the scoops when in the respective retorts.

Fig. 1 is a vertical section of three retorts, with the scoops and scraper-frames carried on a double carriage. Fig. 2 is a part horizontal section of fig. 1. Figs. 3 and 4 are respectively an elevation and plan of the locking bar and its supporting angle.

The main carriage of the charger has embodied with, or fixed upon, it tracks arranged transversely to the stationary track on the floor of the retort-house. The former tracks support the wheels of a second or scoop carriage E, which carries the scoops F, arranged to be capable of entering the retorts. The main carriage C supports a coal-hopper H, divided into three compartments—one for supplying each of the scoops. The main carriage carries an engine for its own propulsion, and another to propel the scoop-carriage on the cross tracks, to move the scoops into and out of the retorts.

The scoops consist each of a long box open at the top and forward end. At the rear end of each scoop, there is a permanent weight, by which it is balanced horizontally with the coal charge in it, and weighed down when empty so as to somewhat lift or tilt up the forward end. While the scoops are in operation, they are locked to the carriage E by means of cranks, the arms of which are made to enter cavities on the carriage; and when the scoops are brought back by this carriage to the position for charging, their back ends are stopped by, and eventually lie on bars fastened to, the main carriage, by the arms of the locking cranks being placed over other cross-bars. Within each scoop, and lying loosely upon the upper edges of it, is a scraper-frame consisting of T-shaped side bars with stops and cross-braces, also a series of scrapers pivoted to the cross-braces, so that their lower edges will swing forward and allow them to pass freely backward over any coal underneath them, but will stop the coal in front of them. A rear scraper with flexible cover is rigidly secured to the scraper-frame, and forms the back coal space in the scoop—entirely emptying the scoop of its coal when the scoop recedes from the scraper-frame. The scraper-frame is moveable back and forth relatively to the scoop to an extent a little greater than the length of the part of the scoop which contains the charge, in order that first, after the scoop with the scraper-frame in it has been moved forward into the retort with the charge of coal nearly to the back end thereof, as illustrated in fig. 1, the scraper may have a still further movement to push the charge of coal up to the extreme rear end of the retort, and, second, that the scoop may (while the scrapers remain thus pushed forward) move back far enough to be withdrawn from the charge in the retort while the scrapers continue to hold back the charge.

In order to counterbalance the weight of the portion of the scraper-frame which, with the scrapers, projects beyond the end of the scoop during and immediately after the discharge of the scoop from the retort, as described, the frame is loaded at its rear end by a weight; and for the purpose of producing the continued movement of the scrapers within the scoop beyond the movement of the latter within the retort, a lever is pivoted to the weight or back part of the scoop—a roller in one end of the lever bearing against the weight or back part of the scraper frame, and the other end with its roller projecting laterally from the scoop. In this way, during the latter part of the forward movement of the scoop, the projecting end with roller comes in contact with a stop carried on the locking-bar angles V, after which the continued forward movement of the scoop causes the scraper-frame and scrapers to move forward with an accelerated velocity relatively to the scoop.

The drawing back of the scraper-frame (to bring the scrapers back into the scoop) is effected by means of a bar L, which slides in guides secured in the scoop. A pulley is journalled on this backing bar; and a second pulley is journalled in a bearing in the rear end of the scoop. A rope or chain M fastened in the scoop leads round the pulleys and is fastened to the scraper-frame; while the frame itself is held stationary by means of hoops on the locking bars engaging hooks on the weight of the scraper-frame, so as to permit the discharge of the coal into the retort by the drawing back of the scoop. The bar L is projected back through the rear of the scoop, as the latter recedes from the scraper-frame, with a movement of two to one in proportion to the movement of the scoop, by means of the pull of the scoop on the rope or chain M. This projection of the backing bar continues until the scraper-frame has been unlocked by the lifting of the locking bar disengaging the hook on the bar from corresponding hooks on the end of the scraper-frame. The locking bar is then immediately, by the continued movement of the scoop, brought against a stop on the main

carriage; and by the further continued backward movement of the scoop, while the bar is so stopped, the bar is caused to be returned within the scoop, and, by the action of the rope or chain M and pulleys, to draw back the scrapers to the position they are to occupy while the latter is being charged and while it is running to charge the retort.

The scraper-frame in the middle retort shows its position when nearly fully retained in the retort, and the scoop brought forward far enough for the scoop-carriage to have scraped nearly all the coal off the scoop. The locking bars are nearly out of engagement, and shortly will be raised by the action of the unlocking or tipping cam P carried on the horizontal inner braces of the scoop-carriage, which raises one end of the locking bars and naturally lowers the other ends, and consequently lowers out of engagement the locking hooks. The position of the scoop-carriage for the relative position of the locking hooks is shown in dotted lines in fig. 1.

Gas-Purifiers.—Dempster and Sons, R., and Broadhead, J. W., of Elland, No. 5910; March 14, 1903.

The purifiers are arranged in fours, in a square or like form; the object of the improvements being "to economize the space and weight of the connecting pipes."

Instead of the valve chamber containing the inlet and outlet valves of the purifiers and the gear for controlling them being above or below the purifiers, the purifiers are so arranged as to leave a central space for the valve chamber.

Several different modes by which the invention may be carried into practical effect are illustrated.

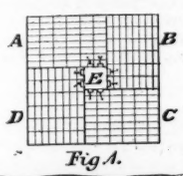


Fig. 1.

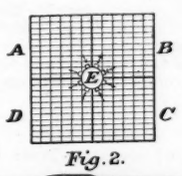
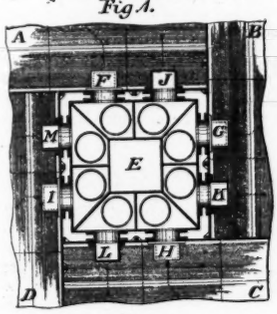


Fig. 2.



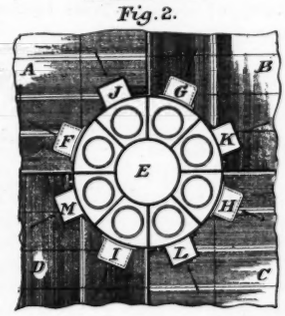


Fig. 1 represents in sectional plan four purifiers A, B, C, D, arranged in a square formation; each purifier being slightly oblong and overlapping at its outer end the inner end of the next purifier, so that a portion of the inner side of each purifier forms one side of the valve chamber E. F, G, H, I, are the four inlets, controlled by valves; and J, K, L, M, are the respective outlets (also controlled by valves). Supposing three purifiers, A, B, C, to be working, and the fourth, D, shut off, the gas is made to pass from the main outlet of the valve-chamber to the first purifier A by the inlet F, then by the outlet J back to the valve-chamber, then by the inlet G to the purifier B, by the outlet K and the inlet H to the purifier C, and by the outlet L to the main outlet valve of the chamber E.

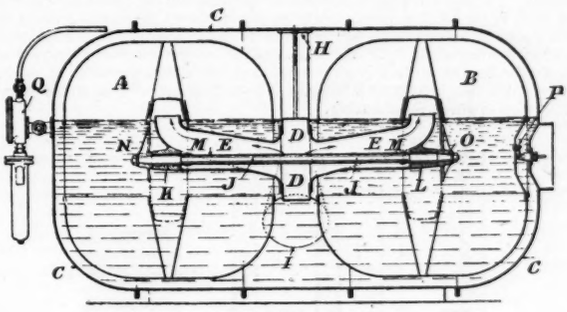
Fig. 2 illustrates a modification in which the valve-chamber E is of circular form—situated in the middle of four purifiers, symmetrically arranged. The valve chamber in any case may either be formed by portions of the walls of each of the four purifiers, as shown in these two figures, or may be a separate body or casing connected to the purifiers by short flanges or connecting pieces.

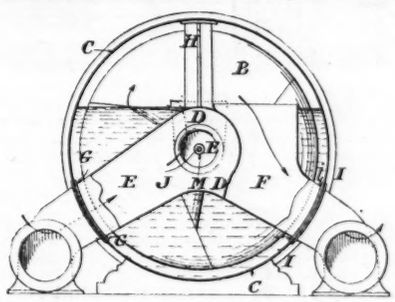
Station Gas-Meters.—Boult, A. J.; a communication from La Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris. No. 6544; March 20, 1903.

The patentees point out that, in ordinary station meters, the speed of the registering drum must not exceed a certain limit as beyond that the resistance of water to the movement of the blades would produce a loss of charge; and as this resistance increases in much greater proportion than the speed of the wheel itself, the maximum number of revolutions of a wheel is the smaller the larger its size. This results in the necessity for making use (in meters of large capacity) of an exceedingly small speed. For ordinary meters of 100,000 cubic metres per twenty-four hours capacity, there would only be 60 revolutions per hour; while a meter of half the capacity may revolve without inconvenience at a speed of 80 to 85 revolutions. Consequently, a meter of 100,000 cubic metres—although its capacity is only double that of a meter of 50,000 cubic metres—must have a measuring wheel three times as large as that of the latter.

Meters of large capacity have, therefore, a much greater volume in comparison with meters of smaller capacity than would be necessitated simply by the quantity of gas passing through them. This inefficient utilization of their volume, the patentees proceed to point out, is not the only defect of meters of large capacity. They have, besides, the drawback of being more difficult to erect, and of working in a less uniform manner, than meters of smaller capacities, owing to the measuring drums of large meters always greatly agitating the water and producing fluctuations of pressure, which, however, likewise take place, although to a much smaller extent, in small and medium-sized meters. Moreover, the construction of large meters as used hitherto necessitates the casing being made exceedingly rigid, as it had to support the whole weight of the measuring drums and the inlet and outlet pipes, and resist the reaction corresponding to the effort made in order to produce rotary movement. In consequence, the casing is always made in the form of a cast-iron cylinder and two discs, which are the most important and the most expensive part of the apparatus. It is also pointed out that, in order to avoid deformation of the rotatory wheels of a large size, it is necessary to strengthen them well by means of angle irons or other braces which, owing to their projecting from the surface of the blades, increase the resistance of the water to the movement.

The above-named drawbacks of old constructions are enumerated so as to enable "the advantages of the meter for large volumes according to this invention to be better understood." It is said to be entirely different from those used hitherto as regards the utilization of the material employed, uniformity of working, and design.





The apparatus shown (in longitudinal and vertical section) is mainly constituted by the two measuring drums A B, either of the "Duplex" type, with central distributing chamber, or as shown. The drums are enclosed in a cast-iron or sheet-metal casing C filled with water to a given level. Gas is admitted into the drums through a central hollow part D, which is simultaneously used as an inlet pipe into the measuring drums by its branches E; as an outlet pipe by its other branches F, through which the gas escapes after having passed through the drums; as a bearing for the drum-spindle; and as a strengthening device, preventing the casing to which the radiating parts G, H, I, of the part D are secured from collapsing. The spindle J of the two drums passes through the length of the central gas-inlet pipe E, and rotates in two bearings K L within the drums—connected by a tube M to prevent water, which might get between the bearing and the journals owing to the existing clearance, from flowing into the central hollow part D. The two drums are mounted on the ends of the spindle J by means of two hubs or sleeves with cross-bars N O; and one of them operates the registering mechanism by means of a pin P. Q is a water-gauge with an overflow syphon, identical with those generally used on ordinary meters.

The advantages of the construction described are said to be as follows:—

(1) The axial strains produced under the action of the pressure of the gas, and the resistence offered by the water to the movement of the blades, acting in opposite directions, counteract each other. The wheels rotate, therefore, under very favourable conditions of equilibrium; and the working is, therefore, much more uniform than that of ordinary meters.

(2) The inlet and outlet pipes and valves, as well as the bearings of the drum-spindle—instead of being mounted on the bottom and on the cylindrical casing as in ordinary meters—are carried by the hollow central part; so that both the front and the back of the casing can be easily removed when it is necessary to examine the interior of the apparatus.

(3) In order to ensure perfect stability of the apparatus, it is sufficient to make the central part D perfectly rigid. This part has, besides, to resist only a bending strain due to the weight of the two drums or wheels; but as the latter are balanced as regards their weight and strains, they do not produce any torsion or vibration in the central part. The outer cylinder and the two covers having no heavy parts to carry, and being entirely independent of the drums or wheels, constitute merely a simple casing, which, unlike that of ordinary meters, may be made of thin sheet metal.

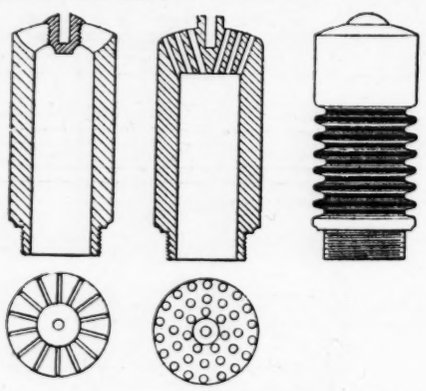
(4) As regards rigidity, the two connected wheels work under much better conditions than a single wheel of the same capacity; so that—at least, for ordinary capacities—it is not necessary to stiffen them with angle irons or the like. Moreover, the blades of the combined wheels have no projections, and so move easily through the water without agitating it, as in meters with a single wheel of large capacity—this agitation being due both to their great circumferential speed and to the

resistance of their strengthening pieces, which are necessary in order to avoid deformation of the blades.

(5) The two measuring drums can revolve at a normal speed corresponding to the capacity of each of them, which is half the total capacity of the meter; whereas a meter with a single drum of the same total capacity could not revolve at the same speed, but would have to rotate at a much slower speed, owing to its large dimensions and for reasons already stated. Consequently, for the same output and for the same absorption of pressure, a single-drum meter would necessarily have to be of a much greater volume and weight than one with two connected drums.

Incandescent Gas-Burners.—Keith, J. & G., of Farringdon Avenue, E.C. No. 6136; March 17, 1903.

The patentees' object is to provide a burner-top suitable for use with water gas and in cases in which the temperature due to the combustion of the gas is of such intensity as to raise to incandescent heat the wire gauze or like material through which the gas issues into the burner mantle. When burning water gas or the like in the ordinary type of burner, firing-back is apt to occur owing to the flame burning down to the gauze or otherwise so heating it as to cause ignition of the mixture within the burner body. To overcome this objection, it is proposed to make the burner with a heavy metal top, such that the bulk of metal distributes the heat and dissipates it by radiation, so that there is no tendency towards overheating.



Three forms of the suggested burner are given. The body or top part of the burner may be of cylindrical or other form, and its crown slit or perforated to allow of the passage of the gaseous mixture to the mantle, which is supported in any usual way. In the third modification, the burner top or body is corrugated longitudinally or circumferentially, or is made with fins for radiating the heat.

APPLICATIONS FOR LETTERS PATENT.

645.—Cornall, R., "Mantle holders. Jan. 11.
669.—Mengwasser, F, "Purifying gas." Jan. 11.
693.—Tomlin, R., and Paull, W., "Diffusers for incandescent gas-burners." Jan. 11.
753.—Johnson, T. K., and M'Kean, W., "Mantles." Jan. 12.
775.—Harrington, R., and Martineau, W., "Incandescent lighting." Jan. 12.
779.—The New Inverted Incandescent Gas-Lamp Company, Ltd., and Bennett, C. S., "Inverted incandescent gas-lamps." Jan. 12.
859.—Taylor, J., "Support for mantles." Jan. 13.
891.—M'Minn, A. C., jun., "Preparation of lime used in gas purification." Jan. 13.
919.—Riethof, S., "Incandescent globes." Jan. 13.
947.—Beal, W., "Shades for inverted incandescent lights." Jan. 14.
966.—Feld, W., "Extraction of ammonia and cyanogen from coal gas." Jan. 14.
973.—Moeller, J., "Mantle support." Jan. 14.
974.—Moeller, J., "Coupling for gas-pipes." Jan. 14.
997.—Melhuish, A. G., "Gas-meters." Jan. 14.
1025.—Hendry, J., "Retaining incandescent gas-burners when fitted to kitchen and other brackets in a vertical position." Jan. 15.
1053.—Deighton, G., "Charging and discharging retorts." Jan. 15.
1058.—Burgess, J. F., "Gas-burners." Jan. 15.
1104.—Kaufhold, M., "Gas-turbines." Jan. 15.
1113.—Cutler, S, jun., "Fastenings for dry-lute purifier covers." Jan. 15.
1116.—Walker, A. J., "Gas globes and chimneys." Jan. 15.
1137.—Mardon, F., "A gas-tight joint for the covers of luteless purifiers." Jan. 16.
1146.—Thorp, T., "Dust filter for incandescent burners." Jan 16.
1159.—Hanwell, H. W. & C. H., "Pendant gas-lamps." Jan. 16.
1160.—Hanwell, H. W., "Flexible tubes for pendant lamps." Jan. 16.
1177.—Winterflood, B. W. & T. R., "Burners." Jan. 16.

New Water Scheme for Leeswood.—At the last monthly meeting of the Holywell Rural District Council, the Clerk reported that he and Mr. Goodman Roberts (the Clerk of the Hawarden Rural District Council) had interviewed the Directors of the Brymbo Water Company with regard to the proposed supply of water to the parishes of Leeswood and Tryddyn. The Company declined to deviate from their original offer—to carry out the works on a guarantee by the Council of 10 per cent. for 20 years upon the outlay; and an agreement would now be drawn up accordingly.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Improved Gas-Bracket.

Sir,—In the "Journal" for the 12th inst., you report an "*Improved* Gas-Bracket." Perhaps you will allow me to say that I do not consider it an improvement to have the "thumb-plug" underneath, instead of at the side, as it is more likely to work loose and cause an escape of gas.

Magnus Ohren.

Jan. 20, 1904.

The Vertical Retort at Exeter.

Sir,—I read with great interest your article on this subject, which appeared in the "Journal" of the 12th inst.

The experimental work which has been done has given results of such value and importance that the trial on a larger scale will no doubt be eagerly looked forward to by all connected with the gas industry. A make of over 13,000 cubic feet of 14½-candle gas from the ton of slack coal, accompanied by increased weight and quality of coke, must be regarded as a most important advance in gas manufacture—more especially valuable at the present time, when 14-candle gas is largely recognized as sufficient for all practical purposes. As might be expected, the tar is sacrificed in the extra gas production; but this seems amply outweighed by the counterbalancing advantages.

Have any experiments been made on the composition of the crude gas, in comparison with that obtained in the ordinary way? It would be interesting to know how this rapid carbonization affects the proportions of carbonic acid and sulphuretted hydrogen, and more especially of carbon disulphide and ammonia.

H. Leicester Greville, F.I.C., &c.

Jan. 22, 1904.

[It is understood that tests to determine the composition of the gas have, and are being made, but that they are not yet ripe for publication.—Ed. J.G.L.]

Sir,—In your article on "The Coming of the Vertical Retort," which appeared in the issue of the "Journal" for the 12th inst., you state that the amount of brickwork in 24 beds of sixes would be 14,907 cubic feet. Would you kindly give the data from which this figure has been derived?

Engineer.

Jan. 24, 1904.

[Our correspondent's question has brought to light an error in the cubical capacity of the vertical retort benches, which both the engineer who made the calculations and the writer of the article greatly regret. The fact was overlooked in making the workings that two ranges of benches in one house were being dealt with, notwithstanding that allowance was made for the two end walls of the second range, thus—

123 × 10·75 × 10·75	=	14,214
Two end walls 6 × 10·75 × 10·75	=	693
		14,907

However, the patentees of the Settle-Padfield system regard the large yield of gas per cubic foot of retort as one of the main features of their system; and they look upon as a matter of importance the lessened size of the house required as compared with machine-worked horizontals and inclines. The various calculations shall be published next week.—Ed. J.G.L.]

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Jan. 20.

(*Before Mr. Justice* Buckley.)

Attorney-General and Others v. Ashton Gas Company.

This was an action brought (in the name of the Attorney-General) at the instance of the Mayor and Corporation of Ashton-under-Lyne, asking a declaration that the defendants are not entitled to deduct income-tax before declaring a dividend.

Mr. Danckwerts, K.C., and Mr. R. J. Parker appeared for the plaintiffs. Mr. H. Terrell, K.C., and Mr. Cann represented the defendants.

Mr. Danckwerts said there were no facts in dispute, and the short point was whether the Gas Company were paying their shareholders dividends in excess of the amount allowed by their Act of Parliament. There were two Acts in question—those of 1847 and 1877. The first of these repealed a former Act, and re-incorporated the Company; but it was largely repealed by the Act of 1877. It incorporated the Companies Clauses Consolidation Act, and also the Gas-Works Clauses Act, which contained a provision restricting the dividends to the limits prescribed by the Special Act, or to 10 per cent. if not prescribed, with the sliding-scale provision under which the dividend might be increased if the price of gas were proportionately reduced. The Act of 1877 was to be read with so much of the former Act as had not been repealed. It gave the Company power to raise additional capital, and provided for a reserve fund and also an insurance fund, which were limited to a

certain percentage of the capital. If the profits in any year were more than sufficient to pay the standard dividend, and the reserve fund was full, the excess was to be carried to the credit of the divisible profits for the next year. This Act had been interpreted by the Court of Appeal, in the case of *Mason v. Ashton Gas Company*,* which was, to a certain extent, against him; but he thought it was distinguishable. In that case, certain gas consumers of Ashton brought an action on the ground that the Gas Company had created a reserve fund greatly in excess of the amount authorized by their Act, by carrying forward year by year large sums of undivided profits—thereby evading the obligation to reduce the price of gas. Mr. Justice Mathew, in the first instance, and in the Court of Appeal Lord Esher, agreed with him (Counsel); but the majority of the Court—Lords Justices Lindley and Lopes—held that the consumers had no control over the affairs of the Company, and were not entitled to raise the question, which could only be taken up by the Attorney-General on behalf of the public. In the present case, the Attorney-General appeared. Having read the judgments in the action referred to, the learned Counsel went on to discuss in some detail the provisions of the Acts dealing with the income-tax, and cited some cases in which its provisions had been interpreted. He said gas-works were charged—why, he could not understand—under schedule A, and not under schedule D; and the treasurer or other officer of the company had to make the return, and was empowered to deduct the income-tax from the amount of dividend payable to each shareholder. Here the Company paid the income-tax before declaring the dividend, and did not deduct it, which was, in effect, paying a larger dividend than they were entitled to under the statute; and he submitted that they ought to be restrained from so doing.

Mr. TERRELL submitted that the Company were justified in what they were doing. They had paid the dividend authorized—which he believed was 14 per cent., owing to the price of gas having been reduced—free of income-tax. The Company were bound to pay income-tax on their profits, and they had done so. What money remained was applicable to the payment of dividends or any other lawful purpose. There was no obligation on the Company to deduct from each individual shareholder his proportion of the income-tax; they simply had the right to do so if they pleased. As between the Company and the Crown, the full income-tax was paid. The expression in the Act of 1877 was "divisible profits;" and his contention was that there were no profits divisible until after the income-tax had been paid.

A long discussion on the Income-Tax Acts followed, in which various points were put by the learned Judge.

Mr. CANN further argued to the same effect.

Mr. DANCKWERTS shortly replied.

His LORDSHIP reserved judgment.

WREXHAM COUNTY COURT.—Jan. 20.

(*Before His Honour Judge Sir* HORATIO LLOYD.)

Rhos Gas Company v. British Electric Traction Company, Limited, and the Wrexham and District Tramways Company, Limited.

This was an action brought by the Rhos Gas Company against the two defendants for the recovery of £23 3s. 3d. in respect of work done. The Wrexham Tramways Company were included in the action by an order of the Registrar, because it was impossible for the plaintiffs to tell which of the Companies was really responsible for the debt.

Mr. A. GRAHAM appeared for the plaintiffs; and Mr. L. HUGH-JONES for the defendants.

Mr. GRAHAM, in opening the case, said that in 1902 an Act was passed authorizing the Tramways Company to construct a line from Wrexham to Rhos; and the Traction Company were assisting in the work. The operations necessitated an alteration in the position of some of the gas-mains; and Mr. W. J. Gale, the Resident Engineer of the Tramways Company, and Mr. G. E. Woodford and Mr. J. T. Byrom, the Secretary and Manager respectively of the Gas Company, met and discussed the matter. The plaintiffs contended that at this interview Mr. Gale definitely agreed that certain alterations should be made, and instructed the Gas Company to proceed with the work, which he said should be paid for without any question. The point was definitely raised as to whether further authority was necessary from any other person; and Mr. Gale stated that there would be no interference from anybody. The work was accordingly proceeded with. Subsequent correspondence, learned Counsel held, proved in the clearest possible way that an agreement had been entered into between the parties. There was absolutely no repudiation of it, or of Mr. Gale's statement that the arrangements were entirely in his own hands. Eventually Mr. Gale wrote that his Company were willing to meet the Gas Company to the extent of £15; but Mr. Woodford replied asking him to adhere to the arrangement to pay the cost of any alterations required. At one stage of the proceedings, the Gas Company moved some mains in Maelor Road, the bill for which was £25 15s. 4d.; and this amount was ultimately paid by the Tramways Company (without prejudice), on account of the total claim. The difficulty arose with regard to the balance. In Gutter Hill, it appeared that when the ground was opened it was found that for a distance of some 50 yards the gas-mains ran just above the angle of an old stone culvert. This was subsequently removed by the Traction Company, and 6-inch pipes substituted. It was agreed as necessary that the gas-mains should be removed; and as it was impossible to lay them on the same side of the road, the Gas Company took them to the other.

Mr. *G. E. Woodford* and Mr. *J. T. Byrom* testified to what took place at the interview; and Mr. *J. C. Belton*, of Chester, gave evidence regarding the necessity for moving the main where the culvert was found. In cross-examination, Mr. Belton said it was necessary where the main was under the Tramway track to alter its position, to avoid inconvenience of access.

Mr. HUGH-JONES, for the defence, submitted that the Traction Company were entitled to be discharged from the action, and said there was no question whatever that the Tramways Company were the people liable. The Traction Company were absolutely distinct from the Tramways Company; but it so happened that they acted as Consulting Engineers, as they had done with reference to other subsidiary companies, and possibly assisted them with finance. With reference to the question of the gas mains, he drew attention to section 30 of the Tramways Act, 1870, which provided that, before the laying down of a tramway in a road in which any mains or pipes, &c., might be, the promoters should give seven days' notice to the company to whom such mains belonged of their intention to lay down or alter the tramways, and should deliver plans and sections of the proposed work. This notice was duly given. There was also a further stipulation that if it appeared that the construction of the tramway would endanger such mains or pipes, or interfere with or impede the supply of gas, the gas company might give notice to the promoters to lower or otherwise alter the position of the mains in such manner as might be considered necessary; and any difference as to the necessity of such lowering or alterations should be settled by arbitration. So that unless his learned friend could prove a definite agreement upon which he could sue, the jurisdiction of his Honour was ousted.

Mr. GRAHAM: I am suing on the agreement.

Mr. HUGH-JONES said he submitted that no agreement had been proved such as would abrogate the statutory privileges and clear away the statutory provision for the protection of the defendants. It might be that Mr. Gale, in the course of conversation, assented to the proposition that the Tramways Company would pay for any alterations they considered necessary to the gas-mains; but this was not a definite agreement.

Mr. *W. J. Gale* said he told Mr. Woodford that where the gas mains were not bared by the actual construction of the tramway, his Company admitted no liability. Mr. Woodford said that where the mains were underneath the tramways, it would be advisable to have them removed, and that the Tramways Company ought to defray the cost. As far as it went, witness assented; but he certainly came to no definite agreement with Mr. Woodford. In fact, he had received no authority to enter into such an agreement, except in cases where the pipes would be bared. The main which ran along the old sewer in Gutter Hill was not actually underneath the track.

In cross-examination, witness said he interviewed Mr. Woodford to decide what alterations should be made provided he got certain information. He did not, however, obtain information as to the depths of the mains. He decided what alterations were to be made in Maelor Road; and his Company paid for them accordingly. He did not determine anything with regard to Gutter Hill.

Mr. *R. J. Howley*, the Engineer-in-Chief of the Wrexham Tramways Company, said he did not agree with Mr. Belton that the obligation of the Company was to remove gas-mains wherever they came under the track. He did not consider that the pipes would be endangered if they were clear of the excavation, nor would the supply of gas be at all impeded.

After hearing the addresses of Counsel, his Honour said he would reserve judgment.

Free Water for Fire Extinction.

At the Durham County Court, on Monday last week, his Honour Judge O'Connor heard an action brought by the Weardale and Consett Water Company against the Chester-le-Street Co-operative and Industrial Society, to recover £15 15s. for water used on the 8th of July last in extinguishing a fire on their premises. The defence was that the plaintiffs were not entitled to sue by reason of the provision in section 42 of the Water-Works Clauses Act, 1847, which specifies that no compensation shall be payable for water used at fires. His Honour upheld the defence, and gave judgment for the defendants, with leave to the plaintiffs to appeal.

A Caretaker's Extravagant Use of Gas.

Mr. Alfred Hargreaves, who was lately sued by the Stoke Corporation for £6 10s. 2d. for gas consumed, will probably in future look more closely after his caretakers. Mr. Hargreaves is the owner of Glebe Buildings, Stoke; and it was proved on behalf of the Corporation that the meter showed the gas consumed there, in the June quarter of 1899, to have been of the value named. The defendant paid £2, but declined to hand over any more; contending that there must have been a mistake in the registration of the meter. The gas bill in the December quarter previous was £3 8s. 9d., and in the March quarter £2 1s. 3d. Evidence was, however, given to the effect that the caretaker on the premises was of very drunken habits, and that the police frequently found the gas blazing away during the early hours of the morning. Thereupon his Honour Judge Mulholland, K.C., gave judgment for the amount claimed, less £1 17s. 11d. paid into Court.

A Water Diviner at Fault.

At the Carmarthen County Court, on Thursday, before his Honour Judge Bishop, Mr. Hugh Stephens, a water diviner, sued Mr. Louis Evans for three guineas, a fee to which he claimed to be entitled. Plaintiff visited defendant's farm in August, 1902, with the object of locating water; and he indicated a spot where he believed water would be found at a depth of 15 or 16 feet. A hole was dug, and when it was about 12 feet deep heavy rain fell, the whole place became saturated, and digging had to be stopped. The result was that about 7 or 8 feet of rain water accumulated in the hole. When the rain ceased, the water was ladled out, and they dug down to a depth of 20 feet; but there was no sign of water. Plaintiff nevertheless claimed that there was "an ample supply." Defendant declined to pay the fee on

* See "JOURNAL," Vol. XLV., pp. 160, 205; Vol. XLVII., pp. 449, 741.

the ground that the plaintiff agreed that if he failed to find water no payment would be expected; and a letter from him to the defendant was put in which bore this out. His Honour came to the conclusion that digging a hole in a dry field, and waiting for the rain to fill it, did not justify the position the plaintiff had taken up He therefore gave judgment in favour of the defendant.

Embezzlement by a Gas Manager.

At the Chesterfield County Police Court, last Saturday week, George Richardson, late Working Manager to the Bolsover Gas Company, was charged on remand (*ante*, p. 106) with fraudulently embezzling certain sums of money received by him on behalf of the Company on various dates during December. The amounts specified in the charge totalled £10 13s. 6d. Mr. John Middleton, who prosecuted, said it was part of the prisoner's duty to make out accounts for charges against customers in respect of fittings, &c. On the 1st inst. he absconded; and he was arrested in Dublin four days later. An examination of the books showed that prisoner had received, and had failed to account for, sums amounting altogether to over £20. His books had been falsified. Evidence having been given as to the payment of the various sums, Police-sergeant Shopland said he received the prisoner in custody at Dublin. When charged, he said: "I took £12 11s., and will pay it back if they will let me." Prisoner pleaded guilty, and asked the Bench to deal leniently with him for the sake of his children. Mr. Middleton said there was not a redeeming feature; and he pressed for exemplary punishment. The Chairman of the Bench remarked that the case was a very serious one; and they felt it their duty to inflict the heaviest punishment in their power—namely, six months' hard labour.

The Dangers of Water-Valve Boxes.

In the Lord Mayor's Court, on Friday, before the Common Serjeant (Mr. F. A. Bosanquet, K.C.) and a Jury, Patrick Donovan, until recently in the employ of the proprietors of the "Evening News," sued the New River Company for damages for personal injuries sustained in consequence of their alleged negligence. The plaintiff was formerly a cyclist newsvendor. On the night of Sept. 3, after finishing his work, he was riding his bicycle along Bishopsgate Street, when the front wheel caught in one of the Company's water-valve boxes in the roadway, which box, it was said, was out of repair. He was thrown to the ground and his bicycle damaged, while he himself sustained serious injuries which had prevented him from following his occupation, at which he earned £3 10s. per week, for a long period. The doctor who attended him stated that three of the plaintiff's ribs were fractured, and he had suffered from inflammation of the lungs and pleurisy, as well as great shock. The defendants denied that they had been guilty of any negligence for which they were responsible in damages. Boxes similar to the one with which the plaintiff's bicycle came in contact had been in use by the Company for upwards of twenty years, and no previous accident had been caused through the fracture of the lid of a box. As soon as the fact that the lid of this particular box was damaged was brought to the knowledge of the defendants, the defect was remedied. The lid was seen a few hours before the accident, and found to be in good order. The Jury returned a verdict for the plaintiff, and awarded him £300 damages.

Dishonest Gas-Works Employees.

The Aldershot Gas and Water Company have lately found it necessary to prosecute three of their employees for stealing coke and coal. In the first case, two young men named Nat Callingham and Thomas Taylor were charged with the theft of four bags of coke, value 4s., the property of the Company. The defendants were sent from the works with two loads of coke, to take to Froyle Park; but while passing through Tongham they sold two sacks of it for a shilling. A plea of guilty was entered; and the Bench in each case inflicted a fine of 30s. including costs, with the alternative of a month's imprisonment. The second charge was one of stealing coals, to the value of 6d., which was brought against James Miles. A constable saw the prisoner leave the works in Ash Road (where he was employed), with his coat thrown over his shoulders; and noticing that he had something underneath, he stopped him and asked what it was. Prisoner answered that it was only a lump of coal; but on the constable making a search, he was found to have a piece under his arm, a basketful on his shoulder, and some in his pockets. It was stated that the constable had been told off to watch at the works, owing to the Company having made serious complaints of thefts. The Secretary (Mr. R. W. Edwards) said the Company were exceedingly sorry to see an old servant in such a position. He had no doubt there were others of their servants who were in the habit of stealing. Mr. Edwards having stated that the prisoner bore an excellent character, the Bench decided to deal with him under the First Offenders' Act. He was therefore bound over in the sum of £2 for six months; and was allowed to go on promising to pay the costs (14s.) within a week.

Weavers Overcome by Gas.—About a dozen weavers were overcome by gas on Tuesday morning at the shed of Messrs. Witham Bros., Plumb Street, Burnley. A strong smell of gas had been perceived by the Manager before work started, and he had the gas turned off, the ventilators opened, and fans set in motion before the operatives were allowed to enter. Later, however, 12 or 14 weavers collapsed, and were carried out of the shed. A medical man, who was called in by the firm, attended to the sufferers, seven or eight of whom, all women and girls, were removed to their homes in cabs. It appears that a tap, which controls 300 lights, had been turned on overnight, and gas must have been escaping from the 300 burners throughout the night. There has been a strike at the works.

MISCELLANEOUS NEWS.

METROPOLITAN WATER ARBITRATION.

(*Before the Right Hon. Sir* Edward Fry, *Sir* Hugh Owen, G.C.B., *and Sir* John Wolfe-Barry, K.C.B.)

Thirty-Fifth Day—Monday, Jan. 18.

The Court, which adjourned on Dec. 21 for the Christmas vacation, resumed its sittings at the Institution of Mechanical Engineers to-day.

Motion by the Corporation of Richmond.

In the matter of the *Southwark and Vauxhall Water Company v. Metropolitan Water Board*, and *Metropolitan Water Board v. The Mayor, &c., of Richmond*,

Mr. Lewis Coward (with him Mr. W. A. Robertson) appeared in support of a notice of motion on behalf of the Corporation of Richmond—that they should be allowed to take part in the arbitration between the Southwark and Vauxhall Water Company and the Water Board. The grounds upon which he made his application were set forth in an affidavit, which he quoted. The old Borough of Richmond, he said, was not within the limits of supply of the Southwark and Vauxhall Company, but was supplied by the Corporation of Richmond. With regard to the "added area" of the borough, by section 12 of the Metropolis Water Act it was enacted that, from the "appointed day," such parts of the Borough of Richmond as were within the limits of supply should cease to be within those limits, and should be transferred and vest in the Council of the borough. The material part of the affidavit was paragraph 6, which stated that "no agreement had at present been arrived at between the Water Board and the Corporation of Richmond regarding the sum to be paid to the Water Board in respect to the transfer to the Corporation of the water-works;" and the Water Board on Dec. 17 last served upon the Corporation a formal statement of claim, thereby claiming the sum of £50,000 in respect of such transfer. The Corporation claimed £50,000 down for the water-works and the plant and the loss of the right of supply, and this was all. The Clerk wrote back that such a sum was excessive.

Replying to the President, Counsel pointed out that the Act distinctly said that as from the "appointed day" the property should be transferred; and it was only right that he should take such part in the proceedings as the Court might think fit he should take when the value of the area was being discussed as between the Southwark and Vauxhall Company and the Board.

The President: Do you wish to do so at your own expense?

Mr. Coward replied that this was in the discretion of the Court, as they would be in the position of parties attending the arbitration.

Mr. Balfour Browne objected on behalf of the Southwark and Vauxhall Company. They were going to be paid for their undertaking as a whole. It was a totally different question as to certain parts concerning the learned Counsel's clients. They would be spending the Company's money; and he did not think the Court would have power to give him costs against them.

Mr. Moulton, for the Water Board, said he could not agree in any way to the application.

The President: The motion is dismissed, with costs.

Application against the Water Board.

Mr. Coward next made an application against the Water Board for particulars of the sum of £50,000 claimed from the Borough of Richmond. There was not a single fact, he said, in the whole statement to explain the figure of £50,000, nor how it was arrived at; and no explanation was made as to the principle on which it was based.

After some discussion,

The President said a division should be made as to how much was appropriated to works and how much to the loss to the Water Board of income; and there would be an order to give particulars of both. A statement must also be made of the basis on which the loss to the Board was arrived at.

The Court then proceeded to deal with the case of the

Lambeth Water Company.

The original claim of the Company was for £5,527,782; the claim as amended amounted to £5,466,923.

Mr. C. A. Cripps, K.C., M.P., Mr. Asquith, K.C., M.P., and Mr. Fox appeared for the Company.

Mr. Cripps, in opening, described the area of the Company's district and their filter-beds and subsidence reservoirs. The filter-beds covered 15 acres. Two of them had been recently constructed at a cost of about £40,000, out of sterilized capital under the Act of 1900. The capacity of the two conduits to bring water from the reservoirs at West Molesey to the filter-beds at Long Ditton was from 36 to 37 million gallons a day. At the present time, the Company were laying a new iron pipe between the subsidence reservoirs and their filter-beds; and looking to the future, this would be necessary. They were not claiming, and would not claim, directly in respect of water brought along the conduits; they were really claiming in respect of the conditions as they were before it was necessary to have recourse to sterilized capital. They obtained 24½ million gallons a day from the Thames at West Molesey. They could also take what was called excess water from the Thames, under certain conditions, to the amount of 20½ million gallons a day. This they did not want; and they were not claiming in respect of it, because they were not claiming on future, but on present income. Then they obtained what was called gravel water from under their works at West Molesey. They were entitled under an Act to raise 7½ million gallons of this a day. Counsel proceeded to quote the various Acts of the Company, dating from the original Act in 1785. The Act of 1848 incorporated in the case of the Lambeth

Company for the first time the Water-Works Clauses Act of 1847. There was an agreement between the London Corporation and the Company in 1851 with regard to the taking of water from the Thames at a certain spot without the consent of the Corporation; and the payment made to the Corporation for this was £200 a year. The next Act was that of 1871, which gave power to obtain water from the Thames at West Molesey. They had the power to take water either at West Molesey or at Long Ditton. Then there was an agreement in December, 1886, between the Company and the Thames Conservancy. The Company were authorized to take 24½ million gallons in twenty-four hours, which was the aggregate amount they took; and the actual payment made was £3250. The Act of 1900 summarized their powers, and showed what they were. The definition of "river water" meant water to the extent of 24½ million gallons a day which the Company were now authorized by statute to take from the Thames; but it did not include gravel water. Then there was excess water from the River Thames in addition to, and exclusive of, gravel water. The well at Selhurst at the present time had been sunk 350 feet down to the chalk. The yield would be about 500,000 gallons a day; but it was not complete at the present time. When it was carried out, they expected a yield of about 2 million gallons a day from this. Counsel proceeded to quote from tables showing the share and loan capital of the Company on March 31, 1903, which he said was the period up to which they made their claim. The effect of this was that £1,043,800 was on the 10 per cent. scale limit of dividend in the Special Act. There was no limit in this table; and this meant that the Water-Works Clauses Act came in. Then, under the Act of 1856, there was £406,200 in respect of which there was a 7½ per cent. limit of dividend. There were other amounts under other Acts. The first Act to which the sterilization clause applied was that of 1900. The sinking-fund clause, the City Chamberlain's clause, was first introduced as regarded this Company in 1886. Counsel then went through other tables dealing with the corrected revenue and net revenue account for the year ended March 31, 1903, and a forecast of the Company's financial future. The table giving the forecast showed what their future would be but for sterilization. He admitted that when sterilization came in, they were not entitled to the future; but it showed what the future would be were it not for sterilization.

Mr. *H. Wilkins*, the Secretary of the Company, examined by Mr. ASQUITH, put in tables showing the population, number of supplies, &c. These showed that the average population for the year ending March 31, 1903, increasing at 2·9 per cent. per annum, was 984,116; and in 1913, it would be 1,043,600. The average number of supplies at 6·24 persons per supply, for the same dates, he gave as 125,660 and 167,243 respectively. Other figures that witness put in related to the net water-rental increasing at 3·3 per cent., deduction of working expenses at 41 per cent., profit on water and on trading, &c. The yearly increase in 1904 would be £100,000; and in 1913, £10,000. The net profit available for purposes of dividend in the year 1903 was £875,753. The actual area of supply in the County of London was about 24 square miles. About 78 per cent. of the whole district was on constant supply. Another table showed the water supplied and the income for eleven years to March 31, 1903. For the year ending March 31, 1893, the average number of supplies was 95,146; and in 1903, 125,660. The estimated population in 1893 was 660,019; and in 1903, 784,116. The average quantity of water supplied was 20,159,054 and 28,931,238 gallons respectively. The supply per head per day was 30·54 gallons and 36·90 gallons; fixed rates (domestic, &c.) £217,734 and £286,175; meter supplies, road watering, and building, £29,651 and £48,430; total, £247,385 and £334,605. Deducting losses on collection, the net water-rental was in 1893, £230,150; and in 1903, £317,628. The supply of water per head should diminish rather than increase. It should not exceed 35 gallons per head. Witness next gave particulars as to the actual claim, which showed that the net maintainable income of £152,014, multiplied by 36·36, was £5,527,782. Repayment of rents and interest paid on unproductive capital, £10,502; value of spare land at Brixton and Upper Norwood not required for the purposes of the present undertaking, £14,225; contingency fund as it existed on Sept. 30, 1903, £42,678; total, £67,405. Less capital sums of £3294 and £2598 respectively, required to be provided as a fund in respect of the capital expenditure in the construction of reservoirs on leasehold sites at Rockhill and Coombe, £5892; and also the following allowances: Repair of culvert, Molesey to Ditton, and other minor repairs, £43,000; total, £48,892; the grand total being £5,546,295.

In cross-examination by Mr. MOULTON, witness said there was an understanding between the Lambeth Company and the Southwark and Vauxhall Company that there should be no competition between them. The terms of the Lambeth Company were higher than those of the Southwark and the Kent Companies. The Company had not taken advantage of the new valuations of property in the district so far as their charges went. With regard to the quality of the water, they had had complaints from the City of London and the Borough of Camberwell calling attention to the report of the Water Examiner. They had complaints also from other boroughs. These, however, must be discounted, because they would not allow the Company to be present when the samples were taken.

Mr. *S. Wood* gave evidence as to checking the figures put in; but he said he was not responsible for the principle on which they had gone. The accounts were accurate so far as the figures were concerned.

Thirty-Sixth Day—Tuesday, Jan. 19.

A discussion took place this morning as to the £42,000 in the Company's contingent fund.

Mr. FLETCHER MOULTON, on behalf of the Water Board, asked whether it was understood that this amount must be handed over at the date of the transfer to the Board.

Mr. CRIPPS, consented that the money should be handed over on the understanding that it should be applied to engineering expenses.

Mr. *T. F. Parkes*, the Chief Engineer to the Company, was then called and examined by Mr. CRIPPS. He said that, in his opinion, the works had been properly constructed and laid. They had four reservoirs, having a total capacity of 465,500,000 gallons. The distributing forces of the Company were all good. In the month of maximum demand, they were able to give a full supply without difficulty—in fact, they had always been able to supply their district from their sources and with their plant. At the present time, they were laying a new pipe of 54-inch diameter; and looking to the future, they would want additional conduit capacity. They could go on for two years before they would require to use the new pipe. It would be finished about the end of March.

The CHAIRMAN: It will be finished about the end of March, but will not be used for two years.

Mr. CRIPPS: It could be used; but we are not claiming for this.

Witness, proceeding, said the total area of the Company's works was about 15 acres. He had made an estimate of the requirements of the increasing population; and he calculated that shortly after 1904, in order to have their supply in perfect condition, they would want the new pipe they were now laying down.

In cross-examination by Mr. FLETCHER MOULTON, witness said that not more than half their water came from the river. He did not agree that the new reservoirs were in a very unsatisfactory state. They were in very good order; and the work was well carried out. Taking it as a 30 million gallons a day supply, they had fifteen days' storage. This was putting the storage at 450 million gallons instead of 465 millions.

Mr. *Charles Hawkesley* said that, as regarded the reservoir works, in his opinion the method of construction was a suitable one for the circumstances which obtained at Molesley. He came to the conclusion that they were substantial works. There was only one place where there was any sign of weakness; and this was at the south eastern corner of reservoir No. 1. There he found cracks in places bearing towards No. 4 reservoir; and therefore he proposed that the wall should be strengthened by concrete buttresses. Outside this particular point, he could not observe any weakness anywhere else. He was informed that the Board had had allegations against some of the reservoirs of the Company; and therefore he went very carefully round the walls.

In cross-examination, witness contended that the walls were in perfect order. The work was substantial, but somewhat rough. In his opinion, the area of filtration was adequate.

Mr. *E. M. Eaton* and Mr. *James Mansergh* also gave evidence as to the condition of the reservoir walls, which practically bore out the statement of the previous witness.

Professor *Dewar* gave the results of analyses of the Lambeth water which he had made, and which he said were highly satisfactory. It was as good as any other London filtered water. It was in 1895 when bacteriological examinations were commenced by the Lambeth Company; and the effect of their prompt warnings on the efficiency of filtration was very apparent by the rarety of turbid samples. There had only been one case between January, 1895, and December, 1903, when the water supply of the Company had not been perfectly clear and bright, as against 96 cases between 1880 and the end of 1894. The condition of the filtration depended largely upon the mode in which the filters were being treated—much depended upon the Engineer. One-fourth of the Lambeth water was already better purified than they could get it by filtration, because it came through the gravel pits. Therefore, this portion had no microbes in it at all; and this helped to make the bulk of the water exceptionally good. Gravel water was always free from bacteria; but for security it should go into the joint supply and be filtered again.

Sir *William Crookes* also gave evidence as to the excellence of the Company's water.

Cross examined by Mr. FLETCHER MOULTON: Do you say that water that comes from gravel is absolutely free from bacteria?

Witnsss: I would not say absolutely; but it is always understood so.

I put it to you, pits of gravel are most inefficient filters?—That may be the case.

Therefore there can be no justification for a statement that water from gravel pits is free from bacteria?—I have not had much experience of that.

Mr. *C. G. May*, Solicitor to the Company, in the course of his evidence, said that what he felt was that there was no doubt their leading officials had had an enormous strain thrown upon them in connection with the arbitration which was entirely outside the duties for which they were engaged; and he contended that these services should be suitably remunerated. The Company recently set aside £7350 for what they thought these claims would be; but he thought, looking at everything, that £20,000 would not be an exaggerated figure to put down to cover this, though, of course, the amount was purely speculative.

This was the case for the Company.

The Case for the Water Board.

Mr. FLETCHER MOULTON then addressed the Court for the Water Board. He contended that the Company's reservoirs were badly constructed, and that, in order to make them fit for their work, a very large sum of money must be spent on them.

Mr. *E. B. Taylor* was the first witness called for the Board.

Thirty-Seventh Day—Thursday, Jan. 21.

Mr. *Taylor* continued his evidence this morning. He said that the reservoirs at West Molesey were certainly not water-tight, and they were certainly not stable walls. The foundations of the concrete walls were entirely unsuitable. The cost of the necessary repairs to the reservoirs he put at £86,000. He considered that the storage-line was at present 3 feet too high. Taking this line, the Company's present storage capacity would be 485 million gallons; but he put it at 385 millions. They had not nearly sufficient reservoir storage capacity. He was of opinion that nothing less than 25 days' storage was sufficient to enable any of the Thames Companies to pass the flood water. At the present time, the Company had about eleven days' storage. Therefore, they would want an additional fourteen days' storage in order to pass the flood water. He considered that each London Company ought to have reservoirs, independent reservoirs, to impound water during floods—reservoirs holding at least five days' storage. They would be independent of one another. He put the five days' storage at 170

million gallons. The Company was very poorly equipped in the matter of filtration area. The total area of the filters was 15⅛ acres. In his opinion, they should have at least 25 acres. Therefore, in addition to the £85,000 for repairs, he considered that it was necessary to spend £193,000 on new impounding reservoirs, £85,000 on new subsiding reservoirs, and £110,000 on filters—a total of £474,000.

Mr. CRIPPS, in cross-examination: With regard to the filters, if the quality of the water is very good at present, then I ought to take off the £110,000 for filters?

Witness: If the Court holds that the water is so good, then you ought.

Mr. CRIPPS next put a number of queries as to the cracks in the walls of the reservoirs.

Witness stated that in one reservoir there were 61 cracks, of which 26 were hair cracks. The biggest crack was ¾ inch wide. All cracks which were not hair cracks most certainly showed that a settlement had taken place.

Sir J. WOLFE BARRY: Have you found any difference of level in these cracks?

Witness replied that he had. He added that the mode of construction of this reservoir was such that it could never be a stable work. There were also cracks in the other reservoirs.

Mr. *G. F. Deacon* gave evidence as to the capacity of the supply. He found, after examining the West Molesey reservoirs, that the Company had practically only five days' supply through their existing reservoirs. If certain additions were made, this might be increased to from 11 to 13 days. But they ought to have a supply of 32 days. Witness described the condition of the walls of the reservoirs, and said that, as an engineering work, they were hopeless as carried out. The cracks were numerous, and irregular settlements had already occurred. The filter-beds were insufficient. He put the cost of the works necessary in this direction at £106,000, and £86,000 as the cost of repairs to the reservoirs.

Mr. *James Watson* said the reservoirs were certainly not well designed. If he might say it, without being hard, they violated every recognized principle adopted either in London or out of it. He agreed with the other witnesses as to the inefficiency of the walls, and considered it would not be safe for the reservoirs to be filled right up.

Sir *Alexander Binnie* spoke as to the depth of the pipes, and then as to his examination of the reservoirs. If the Company filled the reservoir to within a foot of the top, it would almost amount to inviting manslaughter—in fact, that would apply in the case of any reservoir. It should not be within 4 feet of the top. He found the reservoirs cracked in hundreds of places; and he agreed with the evidence that had been given in relation to them.

Thirty-Eighth Day—Friday, Jan. 22.

Mr. *Joseph Parry* said he had inspected the works at West Molesey; and he agreed with the witnesses who had already given evidence on behalf of the Board.

Dr. *Klein* said he had taken analyses of the water of the Company. He had examined 46 samples of the filtered water. He found that 50 per cent. of these contained intestinal bacteria in 10 c.c. or less, and 30 per cent. contained intestinal bacteria in 1 c.c. or less. Compared with the other London Companies, with one exception it was the worst of the lot.

Mr. *Tegg*, Public Analyst and Bacteriologist to the Borough of Southwark, said the evidence he had to tender was as to samples of the Company's water which he had examined since July last. Complaint had been made about the quality of the water. Some of these had come from doctors. He detailed the number of bacteria discovered in the samples.

In reply to Mr. CRIPPS, witness said that a sample taken on Dec. 21 was a bad water. Another, taken on Dec. 16, was not a good water; but he should not have condemned it. He could not say it was injurious; he could only say it was liable to be injurious.

Mr. *C. E. Cassal*, examined by Mr. MOULTON, said as Public Analyst to the Borough of Battersea he had for many yerrs examined the water of the Company. It had been very bad on several occasions last year; and he had condemned samples submitted to him as being unfit for drinking purposes, very inferior, and insufficiently purified for public supply.

In cross-examination by Mr. CRIPPS, witness said that if, the Thames water was properly filtered, it was quite suitable for consumption. The present filtering arrangements of the Company were insufficient.

Mr. *P. Bevan*, Accountant to the Water Board, handed in tables relating to the financial standing of the Company. The accounts of the Company showed that from 1899 to 1903 there had been a decrease in net profits from £152,139 to £147,094.

Mr. *Haward*, Controller of the London County Council, said he had examined the accounts of the Company. He had assumed in his table that the net water-rental had increased at the rate of £9000 a year. His table showed the net water-rental for the past ten years. This rental showed considerable fluctuation. In 1894-5, there was actually a decrease; then rather large increases; and then a falling off. So he thought it was fairly safe to take an average of the ten years; and it worked out at £8748—£9000 in round figures. He found it was corroborated by the growth in the number of supplies during the same period. During the period, the supplies had increased on the average by 3091 a year. If he took the supplies at the rate of the rental received, he gave a figure which enabled the increase to be worked out at £7820 a year. This was well within the figure of £9000 a year which he had assumed. His average for the last ten years included the extra expenditure incurred by the Company in lowering their mains. The Company's average increase in trade profits was only £4122. The total amount estimated to be required on capital account for ten years was £916,049, against the Company's estimate of between £60,000 and £70,000 more. He did not differ from the Company as to the total capital expenditure down to 1912.

Mr. *Cutler Jones*, Solicitor to the Water Board, said he estimated that the cost of winding-up the Company after the award was given would be £3000 or £3500, in addition to the £7000 odd for gratuities to the officers.

Mr. *Mansergh* was called, by permission, on behalf of the Company. He was very much struck with Mr. Brough Taylor's evidence as to the stability of the walls of the Molesey reservoirs; Mr. Taylor having said that there were cracks every 20 feet. So he (witness) went down and saw the reservoirs; and he found that the average distance apart of the cracks in the walls was 55 feet. They varied somewhat in different walls; but, going the whole length of the walls, excepting minute cracks which one would not see, the average distance was 55 feet. He could also find no difference in the level. His inspection inclined him to think that the walls were in a very much better condition than the Court might have been led to determine.

Mr. *Wilkins*, Secretary to the Company, also gave further evidence.

Thirty-Ninth Day—Saturday, Jan. 23.

Professor *Dewar* was recalled to-day on behalf of the Company. He said the gravel water came from either side of the Thames. Samples of the water taken the previous Thursday showed it to contain 16 microbes per cubic centimetre. The water on both sides of the river was equally purified bacteriologically.

This concluded the evidence.

Mr. MOULTON then commenced his address on behalf of the Water Board—referring at the outset to the powers of supply possessed by the Company and their origin. He said that by the Act of 1852 they were granted permission to take water from the Thames at Long Ditton; and a subsequent Act restricted their powers to 20 million gallons a day. By the Act of 1871, they changed their intake to West Molesey, and the Long Ditton intake was stopped except for emergency purposes. The Act of 1871 not only authorized the Company to take water at West Molesey, but also increased their area. The Act of 1886 conferred further power to draw 24½ million gallons of water daily from the Thames. The Act of 1900 gave them additional powers to take 20 million gallons daily from the Thames as excess water, and 7½ million gallons from the gravel. This Act contained sterilization clauses, which had an important bearing on the question. Counsel urged that the gravel water was practically taken from the Thames, and ought, under the Act of 1900, to be included in the 24½ million gallons of excess water. As to the way in which the Legislature had dealt with this gravel water, they said (paraphrasing the clause): "We know that we may be legislating about water taken from the Thames; there is this section of 1894 and these two agreements which relate thereto, but we are going to do a legislative act which is to override them." This was overriding the Thames Conservancy Act and the two agreements, all of which could only apply to the subject-matter of water taken from the Thames. It was obvious that in passing this section the Legislature realized that this might be water taken from the Thames. To sum up his argument on the section, the necessity of a legislative act was felt, and inasmuch as they needed this to give them the power, the Legislature were justified in limiting it, and in charging for all the water just as water taken from the Thames. If he could establish the fact that the view of the Balfour Commission was the correct one, then the Company had no right whatever to go beyond this 27½ million gallons.

The PRESIDENT: I suppose you admit that the burden of proof rests upon you?

Mr. MOULTON: I submit that——

The PRESIDENT: You do not contend to the contrary?

Mr. MOULTON: I am not trying to get an unfair advantage. I admit their title to 24½ million gallons; I admit 7½ million gallons, but I trace it to the 1900 Act. Counsel proceeded to submit that the water substantially came from the river, and contended that for five years the Company had been exceeding their legal rights, and were in the position of being unable to go on because they could not fulfil their statutory obligations. He submitted that the division of the net income between the water which they had a right to, and to claim for, and the water which they had a right to but which they must not claim for was an extremely clever and convenient method. The Company had put on a constant supply, and their burdens had grown without their revenue increasing. The net water-rental had shown a tendency to decrease, and was lower in 1902-3 than in 1893-4. The works were likely to be affected by frosts and droughts. He contended that the Company should have larger reservoirs and a greater acreage of filter-beds, and that they ought to have provided 32 days' storage. They had been trying for ten or twelve years to get a well to help them to supply the increasing wants of their district, but had not yet brought it into use.

Mr. CRIPPS, replying on behalf of the Company, contended that they had acted within their statutory powers, and said there was no suggestion that they had injured anyone by the abstraction of the 7½ million gallons of water daily from the gravel beds. If they had been exceeding their rights, surely the Thames Conservancy would have stepped in and held them responsible. They had legislative recognition of the gravel water, absolutely irrespective of whether it came from the Thames or not. The words "river water" meant water to the extent of 24½ million gallons a day which the Company were now authorized, by statute or by agreement, to take from the Thames, but did not include gravel water. If anyone had been injured, he could come and claim compensation; but they had to find a person who had suffered, or whose legal rights had been interfered with. No such person had ever appeared in the sense of obtaining an injunction or of claiming compensation.

Counsel had not concluded his address when the Court rose.

Suggested Water Purchase at Gosport.—At a conference which was lately held between a deputation of members of the Gosport Urban District Council and the Directors of the Water Company, it was stated that the Council had considered the advisability of purchasing the undertaking. In answer to a direct question as to whether they would accept £80,000, the Directors said that they would not be prepared to do so. They were not, however, able to give any indication of the price at which the Company would sell; and thus the meeting proved abortive. The Council are now waiting to hear from the Directors on the subject.

INCANDESCENT GAS LIGHTING IN PARIS.

On the last day of the year which has just closed, the Paris Municipal Council were engaged in discussing the Budget; and in the course of the proceedings, M. Jousselin presented a report on the subject of the cost of public lighting in the city. The following extracts therefrom, which are translated from the current number of "Le Gaz," will show the effect of the adoption of the incandescent system of gas lighting in place of the older methods of illuminating the streets. The change really dates from the year 1900; and the result has been not only to provide a greatly improved light, but also to considerably reduce the outlay on this branch of the municipal service. M. Jousselin, in comparing the present with the former lighting of the city, went back farther than 1900, and took the figures for the years beginning and ending the past decade. He showed that in 1893 the total illuminating power of the lighting appliances then in use was 78,800 carcels, or, roughly, 750,000 candles; whereas now it is 308,300 carcels, or 3,000,000 candles—a fourfold increase. In 1893, the public lighting expenses were as follows: Gas, 4,019,328 frs.; maintenance of lamps, &c., 1,170,650 frs.—together, 5,189,978 frs., or £207,599. For last year, the expenses provided in the Budget were: Gas, 2,845,000 frs.; maintenance, 1,735,000 frs.—together, 4,580,000 frs, or £183,200. In the period dealt with, therefore, there has been a reduction in the cost of gas consumed to the extent of about 1,175,000 frs., or £47,000. On the other hand, the expenses of maintenance have gone up nearly 630,000 frs., which is accounted for by the fact that an incandescent burner consuming 3½ cubic feet of gas per hour costs, within a fraction, 10s. per annum more to maintain than the ordinary flat-flame burner, passing 5 cubic feet per hour, which it has displaced. Notwithstanding this, the total cost of public lighting in Paris has been reduced about 610,000 frs., or £24,400, in the ten years under consideration. This result, accompanied by an increase of light, was, in a measure, prognosticated in the report on the Budget for the year 1901; and it is interesting, and at the same time gratifying, to find the prediction has been verified.

M. Jouanne, the Technical Editor of "Le Gaz," in offering a few observations on the foregoing figures, remarks that, while the maintenance charges are higher with the incandescent than with the ordinary system of gas lighting, the difference is not so great as was expected at the outset; and the fragility of the mantles should not, he says, be an obstacle to the adoption of the improved method of lighting. He gives some figures, obtained from his own personal experience, in regard to the cost of maintaining incandescent burners in a small seaside town where some of the lamps are exposed to rough weather. Last November, the cost rose to 81 c. per lantern, and in the following month to 93 c. In September, however, owing to storms, it reached 1 fr. 18 c. These figures show that the sum of 12 frs. per annum, which was specified for the maintenance of incandescent burners and lamps in the contract entered into between the European Gas Company and the Municipality of Boulogne-sur-Mer, to which reference was made in the "JOURNAL" for the 3rd of November last, is about right. It is, moreover, borne out by a number of cases, which show an average of 12 frs. to 13 frs. per annum.

FACTS FOR ELLAND RATEPAYERS AND CONSUMERS.

In announcing a reduction in the price of gas from 2s. 9d. to 2s. 6d. per 1000 cubic feet, as from the 1st inst., the Engineer and Manager of the Elland Gas Company (Mr. Robert Porter) gives some interesting figures with regard to the relationship which exists between the ratepayers and the Company. After expressing regret that, owing to the costly opposition of the Elland Urban District Council to the Company's Bill, and the further threatened competition of their electric light undertaking, it was impossible to make the reduction at the beginning of last year, Mr. Porter continues as follows.

Many statements have been made in public with the intention of prejudicing the ratepayers against the use of gas for lighting purposes. Such have no foundation in fact. Consumers are constantly being advised to use the electric light in preference to gas, not because the former is cheaper or more efficient than the latter, but in order to enable the Council to make ends meet. The public have been informed that 75 per cent. of the Gas Company's profits go out of the district. This, like many other misleading statements, is untrue. The person responsible for this statement must have had in mind the action of the District Council, who send the whole of the interest and sinking fund charges on the electricity works out of the town. Contrast the above with the practice of the Gas Company for many years, as the following tables illustrate:—

Table showing the Gas Sold and Money Received from the Elland Ratepayers for the Past Ten Years.

Gas sold.	Net amount received.
503,139,000 cubic feet.	£64,175 17s. 4d.

Equal to 2s. 6½d. per 1000 cubic feet sold.

Table showing the Amount Paid to Elland Ratepayers as Wages, Rates, and Dividends and Interest for the Past Ten Years.

	£	s.	d.
Wages	24,409	19	10
Rates	3,292	6	5
Dividends and interest	15,495	3	5
	*£47,197	9	8

Equal to 1s. 10½d. per 1000 cubic feet.

* Does not include salaries and tradesmen's accounts.

Thus for every 1000 cubic feet of gas sold into Elland, and costing the Elland ratepayers 2s. 6½d., no less a sum than 1s. 10½d. has been returned to support the town and trade of Elland.

PROPOSED REMOVAL OF THE ILFRACOMBE GAS-WORKS.

The Ilfracombe District Council met last Tuesday to consider proposals in connection with the contemplated removal of the Gas Company's works to Hele. This place is about two miles from the town; and a few years ago the Company obtained parliamentary powers for the erection of works there. Mr. H. A. Palmer, who presided, said that for many years the removal of the gas-works from the town had been regarded as a desirable improvement; and now that the Company were extending their mains to Combmartin, several members considered it a favourable opportunity for taking action with a view to bringing this about, and of securing the site for the exection of offices and stores. A report was presented by the General Purposes Committee respecting a conference with the Directors of the Company, at which there was a full discussion as to the terms on which they would be prepared to advise the removal of the works. It was decided that if the Company would do this within two years, and let to the Council on lease, with the option of purchase, such portions of the existing works as might be agreed upon, they should contract with the Company for the public lighting for a period of five years, on terms to be approved. The Chairman said he had a long letter from the Electric Lighting Company, and now was the time to have offers from both Companies. The Clerk advised that the adoption of the report of the General Purposes Committee did not absolutely bind the Council to accept the Gas Company's terms; and on this understanding it was decided to adopt the report, and to refer the matter to the Committee for further consideration, in conjunction with the letter from the Electric Lighting Company.

THE PUBLIC LIGHTING OF WINDSOR.

We are pleased to learn from Mr. Herbert Buckley, the Engineer of the Windsor Royal Gaslight Company, that the conclusion arrived at from the proceedings at the recent meeting of the Town Council was not quite correct. It was stated in last week's "JOURNAL" that it had been decided to adhere to electricity for the public lighting; but Mr. Buckley points out that the matter was referred back to the Lighting Committee for them to arrange a more equable distribution of illumination for both gas and electric light, and not electricity only. Both Companies will, therefore, have to submit amended tenders to meet the altered requirements of the Committee. The latter recommended the Council to accept the tender of the Electrical Installation Company for the lighting of the town during the next five years; and an amendment that the tender of the Gas Company be accepted was rejected by the meeting. The confusion arose over a subsequent amendment moved by Alderman Hollis, and carried, which was stated to be in these terms—"That the tenders be referred back to the Lighting Committee, to enable them to prepare a tender for a more equable distribution of electric light." But this, and the inference drawn from it that electric lighting had in principle been accepted, happily prove to be incorrect; and we can only hope that when the matter again comes up for consideration, Mr. Buckley may be successful in securing the contract. He certainly will be, if the best light wins.

GAS COMPLAINTS AT BURSLEM.

More Purifying Power Needed.

The Burslem Gas Committee have been considering a matter to which their attention was called by two of the consumers—namely, "the nuisance caused by the smell arising from the gas." An inquiry was instituted, as the result of which it was said that the inferior quality of the gas recently supplied arose partly from the great demand for gas fuel during the winter, and partly from insufficient purifying apparatus; and the Gas Manager (Mr. Henry Peaty) was instructed to draw up plans for additional purifiers.

At the last meeting of the Town Council, it was recommended that these plans should be referred to a Sub-Committee, and that Mr. Peaty should be asked to prepare estimates of the cost of carrying out his scheme. Mr. Malkin asked whether the bad smell of the gas about which they had received so many complaints had been detected by the Gas Examiner. Alderman Wood said that it had not, because he made his analysis at a time when there was no bad gas generated. After investigation, it had been found that it was due to a consignment of inferior coal. But if the purifying apparatus had been equal to the demands made upon it, the sulphuretted hydrogen which caused the unpleasant smell would not have found its way into the gas. It would be absolutely necessary very shortly, whether the consumption of gas did or did not increase, to extend the purifying plant. Mr. Malkin said what was needed was some responsible person who could be constantly employed in testing the gas. The minutes were then confirmed.

Lighting of Birkdale and Ainsdale.—Much improvement has of late been effected in the lighting by gas of Birkdale and Ainsdale, suburbs of Southport. The lamps in the first-named township have been altered to the incandescent system, and the light has been much improved. In Ainsdale, since the Birkdale mains have been used to convey gas from Southport, the lighting is much more satisfactory. It has now been decided by the Ainsdale Authority to continue it seawards; and the extension will be made next season. It is expected that the Esplanade will then be taken in hand, and form part of the larger scheme of lighting the entire length to Birkdale. This will effect one of the finest improvements on the coast of Lancashire, and when completed will make one of the most extensive and best-lighted marine drives in the kingdom.

SLOT CONSUMERS AND WARRINGTON GAS PROFITS.

Mr. Bullock, a member of the Warrington Trades and Labour Council, has placed before that body what he considers to be a grievance of the slot-meter consumers. In moving that the Trades Council should request the Corporation to make a concession in the price for gas supplied on the prepayment system, he pointed out that large profits were being made by the gas undertaking, and the price charged to the ordinary consumers had already been reduced. Mr. Eaton remarked that he had been given to understand the Gas Committee had the matter under consideration. Mr. Stott said he was of opinion that no profit at all should be made out of gas. The profits which were obtained went towards the reduction of the rates, and therefore did not benefit the working classes to the same extent as they did the employers, who were large ratepayers. If the gas was sold at cost price, the working classes would benefit to the same extent as would the employers and property owners. Mr. Bullock's proposition was agreed to.

THE BRISTOL GAS POISONING CASE.

In the "JOURNAL" for the 5th inst., we reported a fatality arising from the leakage of coal gas into a house in Deep Pit Road, Bristol, in the early morning of New Year's Day. The victim was Elizabeth Sarah Ann Beese, aged 17, the daughter of a miner, who was found dead when medical assistance arrived; the father and other occupants of the house being unconscious, but subsequently recovering. An inquiry into the circumstances attending the occurrence was opened on the Monday following it, and adjourned till last Tuesday, to allow of the father being sufficiently restored to health to give evidence.

The first witness called at the initial inquiry was a married sister of the deceased, who stated that on hearing of the accident and going to the house she found the air in the bedroom so full of gas that it could not be endured for any length of time. There was no gas installation of any kind in the place. Dr. J. Young, the Divisional Police Surgeon, who was called in, said he found the deceased sitting in a chair in the back kitchen, and the father lying there. The whole house smelt strongly of gas, which was also perceptible in the front of the building. Seeing the serious condition of the eldest girl, he devoted his attention to her. With assistance, he started the process of artificial respiration; but at the end of an hour there was no noticeable change, and he came to the conclusion that life was extinct, He should have administered oxygen had any been obtainable near. Death was due to coma, caused by the inhalation of coal gas. He noticed that the gas emanated from the drains, which ran along in front of the house; and it was very plainly coal gas, and not that generated in sewers. Aaron Beese, a brother of the deceased, said there was no perceptible odour of gas when he went to bed at 8.45 on the evening before the occurrence. At midnight he got up on hearing the signal of the advent of the New Year, and opened the window, as he felt sick. There was then a smell of gas about the place; but he did not take any notice of it, and went back to bed. The next thing he remembered was a woman attempting to restore him in the morning. Alfred Tyler, a tipper employed at the same colliery as Beese, deposed that as he did not arrive at work at the usual time on the Friday morning, he (witness), with three other men, went to the house, which they found locked up and quiet. He procured a ladder, and, going up to a window, heard the previous witness and his niece moaning. A boy was sent through the window to open the front door, so that witness might enter. When he got inside, the fumes of the gas were so strong that he had to pause and recover his breath before entering Beese's bedroom. He opened the window, and sent men for the police and a doctor. At this stage the inquiry was adjourned.

On the resumption of the proceedings on Tuesday, Dr. Young was recalled, and stated that his *post mortem* examination of the deceased's body showed that death was due to carbon monoxide gas poisoning. Jesse Beese, the father of deceased, said he went to bed at about ten o'clock on the last night of the Old Year, and at that time he did not perceive any smell of gas. About twelve o'clock his wife awoke him; and he remembered nothing further till the next day, when he became conscious of someone trying to restore him. He had lived in the house for more than three years, and had never detected any smell of gas about the place. Mr. Albert Jones said he was Superintendent of Mains of the Bristol Gas Company. He produced a map of Deep Pit Road, showing the positions of the gas-mains and sewers. From the front of Beese's house to the main the distance was about 46 feet. Directly witness was informed of the occurrence, he went to the spot and found evidence of extensive gas leakage, emanating from a storm-water drain sink, situated about 3 ft. 6 in. from the front of the house. The drain was opened, when it was then found that it was connected with an old stone drain from the scullery, which carried the water into the storm-water pipe outside. Men were engaged in opening the road till noon on the 2nd of January, when a fracture in the gas-main was discovered 86 feet from the garden wall. The gas had evidently got into the sewers through a defect in the joints of the stone drain and storm-water pipe, which were quite 1 inch apart. The fracture in the main was a clean hole about 2 inches round, evidently caused by some very heavy body passing over the roadway above. The main was between 2 ft. 6 in. and 3 feet below the surface, and the main sewer some 7 or 8 feet below again. Witness could not understand how the gas could have travelled 86 feet through almost impervious clay, unless it had a channel of some sort; but no such channel had been discovered. The whole thing was a mystery, and would remain so unless the channel was found. The fact of a heavy vehicle having passed over the roadway and caused the fracture of the main was shown by the depressed condition of the pipe at the point of leakage. The surface of the roadway also showed this by its rutted and broken condition. Though the main was 30 years old, it was in excellent condition. Mr. J. W. Kirley, the Chief Inspector of Nuisances to the Corporation of Bristol, said that he had examined the pipes in question, and it appeared that the sink in the scullery spoken of by the previous witness had not been used for a long time, the trough having been taken away. He thought the gas had probably travelled to the house in the trenches in which the pipes were laid, as the soil would be looser than that surrounding it, and thus lead to easy percolation. The gas could not escape by the surface, owing to the frost, which had bound the road metal. Mr. J. Phillips, the Secretary of the Gas Company, said they took every possible precaution against escapes—even to giving rewards to their employees for discovering and reporting them. The Coroner, in summing up, said it was necessary that the inquiry should be exhaustive, as the occurrence had not only been the cause of one death, but had led to a narrow escape of three or four other persons. The Jury returned a verdict that death was due to carbonic oxide gas poisoning, caused by a leakage of coal gas into the house.

GLASTONBURY CORPORATION GAS UNDERTAKING.

Local Government Board Inquiry.

Last Thursday, Mr. E. P. Burd, one of the Inspectors of the Local Government Board, attended at the Town Hall, Glastonbury, to consider an application by the Town Council for a Provisional Order, to partially amend the provisions of the Glastonbury Corporation Gas Act, 1900, relating to the re-borrowing of the moneys raised under the Act, and to make provision for the repayment of the loan, &c. The Town Clerk (Mr. R. T. Gould) furnished details as to the population of the borough, its rateable value, and the extent of outstanding loans. He next gave an outline of the proceedings which led to the purchase of the gas-works, and the difficulties experienced in raising a loan of £42,000. In round figures, they now wanted to raise £45,000, which, he said, was about £2564 in excess of their borrowing powers and of the original loan. The £42,000 would be paid off out of the £45,000, and a permanent loan created. Of the £2564, some would be used for new works, meters, stoves, mains, &c., and a portion would be set aside for working capital. The revenue from the undertaking had considerably increased since it was acquired by the Corporation. The award in the arbitration was based on an income of £811; whereas now it was approximately £2000. Alderman J. Morland, the Chairman of the Gas Committee, gave evidence bearing out the Town Clerk's statement. Mr. D. E. Garlick, the Manager, explained how the extra loan would be spent. Since December, 1900, the increase in the quantity of gas sold was over 6 million cubic feet; in the number of consumers, 359; in cooking-stoves, 279; in meters, 388; and in profits, £1029. A statement was put in showing that the profits in 1899 were £599 16s. 4d.; in 1900, £748 8s. 1d.; and in 1903, £1777 19s. 1½d. The Town Clerk said the Corporation were anxious to have the loan for a period of 40 years, dating from the time it was advanced.

THE MARYLEBONE ELECTRIC LIGHTING MUDDLE.

Ratepayers Refuse to Sanction the Council's Bill.

The Statutory Meeting of Owners and Ratepayers of Marylebone, called to consider the Bill promoted by the Borough Council to enable them to raise funds to acquire the plant of the Metropolitan Electric Supply Company, was held last Tuesday evening, in the Queen's Hall, Langham Place—the MAYOR (Rev. H. Russell Wakefield) in the chair. The hall was crowded, and the proceedings were very uproarious.

The MAYOR, in opening the meeting, remarked that the ratepayers had been called together because a great crisis in the history of an important borough in London had been reached, and also because what they might do in regard to the matter must have a considerable influence upon other boroughs which might attempt anything of the same kind. They were there because the Borough Council had, by a considerable majority, decided to promote a Bill in order to pay money which was due to the Metropolitan Electric Supply Company in consequence of the award which had been made. Against the scheme they had the objection entertained to municipal trading altogether. In many respects he was with them in that matter; but his difficulty was that it was rather late in the day to deal with it there. If the Legislature desired effectually to protect the ratepayers against municipal trading, they should require the latter to be consulted before large schemes such as the one before them were initiated. In any case, fresh parliamentary powers must be obtained to meet the award in the arbitration. They might reject the Bill, and let come what might; but was this position a moral one? He felt confident that they would maintain the good reputation and credit of Marylebone, whose present indebtedness was less than that of any other Metropolitan Borough.

Mr. E. R. DEBENHAM, the Chairman of the Council's Electric Supply Committee, said the Act of Parliament under which the arbitration took place provided that the Council must buy and the Company must sell; and refusal to raise the requisite purchase-money by additional parliamentary powers might result in an application for a *mandamus*, and the sequestration of the borough rates. The Company had offered to relieve the ratepayers of all liability, providing the Council were content with receiving half profits. Two companies had that day offered to manage the undertaking on terms which, if accepted, would free the borough from any risk of loss. There was no intention whatever to raise the price of current. On the contrary, it was sought to lower it, so that electricity might be used by the working classes. He formally moved approval of the Bill.

Alderman ELGOOD, the ex-Mayor, said that, although opposed to municipal trading, he would second the motion, because he thought it was the only way out of the difficulty. He wished a compromise could be effected; but the terms of the Company were so onerous that they could do nothing with them.

The Hon. HERBERT GIBBS, the leader of the opposition to the Bill, said the non-acceptance of the motion would have no effect in stopping

a compromise with the Company. The scheme was a disastrous one; and he advised the electors to reject the Bill absolutely, and refuse to allow the Council to borrow sixpence until their consent was asked as to how the money was to be spent. They would respect the sanctity of a contract made by themselves; but they would yield to no one in their determination to upset, by every legal means in their power, contracts made by other people without their consent and with their money. If the meeting rejected the Bill, another would be promoted to sweep away the whole of the award and the whole network in which the Council had entrapped them. The scheme was a huge speculation, and an intolerable injustice to the ratepayers. Would they assist in the violation of their undoubted rights, and permit the Council to spend their money without their consent? [Shouts of "No" from every part of the hall.] There was only one answer that men of sense and spirit could give—a resolute and indignant refusal.

Several other speakers having vainly attempted to obtain a hearing, The Mayor put the motion approving of the Bill; but it was rejected by an overwhelming majority.

The announcement of the result was received with prolonged cheers; and, amid much uproar, the meeting was brought to a close.

Meetings of the Borough Council.

The Marylebone Borough Council had two meetings on Thursday, at which the electric lighting question was discussed. At the ordinary meeting, in the afternoon, the Finance Committee reported that they had examined accounts, including that for the sum of £60,000 to be paid by order of Mr. Justice Buckley to the Metropolitan Electric Supply Company, Limited, on the 31st inst.; and they recommended the Council to order payment of the same. Mr. E. White cautioned those who signed the cheque against the possible effects of doing so. He said they had been unjust stewards, and the ratepayers were in no sense liable for what the Council had done. He should vote against the payment of the £60,000, as he believed their acts had been illegal and *ultra vires*. Those who signed the cheque laid themselves open to surcharge. Mr. Warren proposed the postponement of the payment until after the poll of the ratepayers. This was seconded by Mr. Lea-Smith, who said he thought Tuesday's meeting had entirely altered the aspect of affairs. Mr. E. R. Debenham said the Court had ordered the payment of the amount before the 31st of January, while the poll could not be taken before the beginning of February. It would be desirable to take a division, and they would then know who were guilty of contempt of Court should the issue arise. He maintained that they had not acted in any way illegally.

In the evening, a special meeting was held to take into consideration and determine upon the expediency of confirming the propriety of the promotion of the Council's Bill. The Mayor said that since Tuesday's meeting there had been overtures which were likely to reconcile certain conflicting views, and it was therefore very important indeed, in view of the poll, that they should be considered that night. Mr. Debenham formally moved that the Council confirm the propriety of the promotion of their Bill. Colonel Hopkins moved that the matter be adjourned until after the poll was taken; and it was finally resolved that Mr. Debenham's motion be adjourned for three weeks. Dr. Walter Leaf again brought forward the recommendation of the Finance Committee that the £60,000 be paid to the Metropolitan Electric Supply Company, Limited. Sir E. Galsworthy moved that the matter be brought before the Court, so that the decision of the Judge might be taken. He pointed out that, when the order was made, the Court did not know the opinion of the ratepayers, but would now know that they had rejected the Bill by an overwhelming majority. Mr. Debenham said they must not let the 31st of January pass without the money being paid, unless the consent of the Company was obtained. He moved the adjournment of the matter till next Thursday, to see if the Company would wait for the money till after the poll. The Mayor said he felt sure the Company could not force the money out of them before the poll was taken. He was willing to have an interview with them, and he had no doubt that they would readily agree to the payment being deferred. Sir E. Galsworthy having withdrawn his amendment, it was agreed *nem. con.* that the question of payment of the £60,000 should be adjourned till Thursday next, and that in the meantime the Mayor should ask the Company to agree to the postponement of payment till after the poll. Mr. Debenham remarked that the logical conclusion of this was that they should ask for a poll. In view of the decision of the meeting at the Queen's Hall, he proposed that a poll of the ratepayers should be taken on the question of the Bill. On a division, 39 votes were recorded for the poll, and 13 against it.

Mr. Debenham next called the attention of members to a letter received from the General Electric Company, Limited, and, in view of the proposals contained in it, moved that the Electric Supply Committee should be empowered to enter into a provisional agreement on the lines of the letter, either with the Company or any other firm of sufficient stability. He said he did not suggest that the Council should decide upon the subject that night, but should allow his Committee to have a provisional agreement drawn up. He proposed to get tenders from such firms as the British Westinghouse Company, the British Thomson-Houston Company, the Algemeine Electrische Gesellschaft, Dick, Kerr, and Co., Siemens Brothers, and Edmundson. Mr. Sieveking seconded the proposition.

After some remarks from Sir E. Galsworthy and Mr. White, the former moved the adjournment of the debate till Monday (yesterday) evening.

Glyncorrwg Gas Supply.—Colonel A. C. Smith, R.E., one of the Local Government Board Inspectors, on Thursday last conducted an inquiry into an application by the Glyncorrwg Urban District Council for sanction to borrow £1700 for laying a 6-inch cast-iron main from Cymmer to Blaengwynfi, in lieu of a 3-inch one which was put down by the Llynvi Gas Company. Evidence was given on behalf of the Council by the Clerk and Engineer (Mr. W. P. Jones) and the Chairman (Mr. H. John).

METROPOLITAN WATER BOARD.

Cost of the Arbitration.

At the offices of the Metropolitan Asylums Board, last Friday, the first meeting of the Water Board after the recess was held under the presidency of Mr. E. M. Beachcroft. A report was presented by the Special Arbitration Committee, in which they stated that the Board had approved estimates which, together with those previously passed, amounted to £92,000, in respect of the expenses to be incurred to Dec. 31, 1903, in connection with the preparation and conduct of the cases of the Board before the Court of Arbitration. The Committee had had under consideration a report by the Solicitors with reference to the probable expenditure to be incurred for the remaining three months of the financial year; and they found that the total liabilities during that period were estimated at £43,500. As had previously been pointed out to the Board, it was somewhat problematical to frame an estimate in cases such as that now being conducted, and this estimate might be exceeded or might not be reached. The amount depended to a considerable extent upon the result of the appeals to be made against the decisions of the Arbitrators. They had forwarded an estimate of £43,500 to the Finance Committee, and now recommended that the estimate should be approved. The Chairman, in moving the adoption of the report, gave an account of the arbitration proceedings, and stated that they would now be completed in two or three weeks. The recommendation of the Committee was adopted. Mr. F. E. Harris, the Borough Treasurer of West Ham, was unanimously elected Accountant to the Board, at a salary of £1000 per annum. It was resolved, on the recommendation of the Works Committee, to ask the London County Council to continue up to April 30, at the expense of the Board, the examinations of water conducted by their Chemist, and to arrange for the continuation until the end of June of the records of rainfall in the Thames Valley and in parts of Wales.

MANCHESTER CORPORATION WATER SUPPLY.

Statistics of Supply and Rainfall.

A return has been prepared by Mr. W. Blackstock, the Secretary of the Water Committee of the Manchester Corporation, showing that during last year the volume of water supplied daily over the city and district reached an average of 32,752,561 gallons. The lowest average daily consumption was in January, 31,682,777 gallons; and the highest in July, when it reached 34,311,287 gallons. The proportion of the daily supply averaged 25,428,747 gallons from Longdendale, and 7,323,814 from Thirlmere. The total daily consumption during 1903 was higher than that of any previous year; the two next highest averages being 32,439,893 gallons in 1899, and 32,294,958 gallons in 1900. In no other year on record has the average supply equalled 32 millions daily. As illustrating the enormous growth of the area of supply within the last half century, it is interesting to note that during the six years from 1855 to 1860 inclusive, the average quantity of water supplied per day was 9 720,515 gallons; in the next decade (1861 to 1870), it was 11,783,261 gallons; from 1871 to 1880, it averaged 16,337,030 gallons; in the following ten years (1881-90), 19,576,608 gallons were supplied; between 1891 and 1900 inclusive, the quantity reached an average of 27,616,166 gallons daily; while the past three years have shown an average of more than 31 millions.

Another return gives figures relating to the rainfall of the past year. At Thirlmere, there was an average, as ascertained from six gauges on the hills east and west of the lake, as well as in the valley, of 127·4 inches. Gauges have been in use in the same places ever since 1877; and in all the years which have since elapsed, the abnormal record of 1903 has never been reached. The average rainfall in that district for the whole of the 27 years is 87·1 inches; and only on six previous occasions has a depth of 100 inches been recorded. In 1897, the average depth in the six gauges was 105·9 inches, which marks the next highest rainfall to that of 1903. The greatest fall for one month last year was 23·5 inches during October; in March, it was 18 inches; in February, nearly 16 inches; and in January, upwards of 14 inches. The foregoing figures relate to Thirlmere. In the Longdendale district, the total rainfall for the year was only 51·13 inches, against the 127·4 inches of Thirlmere, and in the rainy month of October it reached only 9 inches as the maximum fall. In no other month was the rainfall gauged at much more than 5 inches.

BURSTING OF A RESERVOIR AT BLOEMFONTEIN.

Great Destruction of Life and Property.

Last Sunday, a terrible disaster, resembling somewhat the Dale Dyke catastrophe at Sheffield many years ago, visited Bloemfontein. Following upon exceptionally heavy rain, a small stream, a confluent of the Modder River, rose to an abnormal height. The weight of water broke down a retaining wall, and this was followed by the bursting of the great dam at Brandkop. The result was the flooding of the lower portion of the town, practically the whole of which, comprising the Royal Hotel, two others, and about 176 houses, was destroyed. On Tuesday, the bodies of 23 of the victims of the disaster were recovered; and it was estimated that as many as 60 people had been drowned. Owing to communication between the north and south of the town being cut off, relief work was organized separately on either side, and numbers of homeless people, of whom there were altogether about 300, were accommodated temporarily with food and shelter in the Town Hall and various Government institutions.

An eye-witness of the disaster gave the following account of it to the correspondent of the "Daily Express": "The rain

fell in tempestuous sheets just before the disaster, driving the inhabitants indoors. Almost immediately the Bloemspruit became a white foaming wall, and rushed through the town, demolishing the flimsy iron and wooden shanties in its track like matchwood. The water of the spruit ran through the streets on its banks with the speed of a millrace. There were many heroic acts performed by rescuers. Ropes, chains, telegraph wires, and twisted sheets were all brought into use, and some daring spirits clambered from roof to roof to take the women and children to places of safety. The houses, however, crumbled beneath them, and many times the rescuers had to swim down stream, where they climbed into trees, dragging women and children after them."

PROPOSED NEW WATER REGULATIONS.

Our readers may remember that at a conference held in London last November of representatives of water authorities, the Royal Institute of British Architects, the British Association of Water-Works Engineers, and the Plumbers' Company, a Committee was appointed to deal with the question of the prevention of waste of water in domestic use, the standardization of fittings, &c. The Committee held a meeting on Saturday at the Guildhall—Sir John Knill, Master of the Plumbers' Company, presiding. Dr. Crawford was appointed Chairman, Mr. R. W. E. Coles (the Clerk to the Plumbers' Company) Secretary, and Mr. Percy Griffith (Secretary of the British Association of Water-Works Engineers) Assistant-Secretary. The Secretary presented a report in which he stated that, acting upon the instructions of the Plumbers' Company, he had collected a large amount of information bearing on the subject to be dealt with by the Committee. Schedules were now being prepared collating the bye-laws and regulations of various authorities, and relative data were being arranged in a convenient form. The information furnished was unique in its fulness and in its authoritative character. He further stated that a schedule was being arranged comparing the Local Government Board's model clauses as to water supply with the corresponding regulations of 45 of the principal water authorities supplying populations of more than 100,000. The schedule showed a considerable number of points on which there was substantial agreement. The report was received and ordered to be entered on the minutes; and Sub-Committees were appointed to deal with bye-laws and regulations, fittings and materials, and workmanship. The terms of reference to the Sub-Committees having been decided upon, a resolution was passed that authorities supplying 100,000 people or upwards, who were not yet represented on the Committee, should be asked to send delegates, and that the Chairman and Secretary should be empowered to add the names of any gentlemen whom they thought it advisable to have there. The Secretary further stated that the communications which he had received from the Board of Trade and the Local Government Board justified him in saying that there was a disposition on the part of both Departments to take full advantage of the work of the Committee in bringing about better regulations. They would give facilities for the Committee to ascertain their practice, and would permit a reference to them of various points of detail. It was decided to invite representatives of the associations of master and operative plumbers to give their assistance in the discussions that would arise on the practical questions of materials and workmanship.

GAS SUPPLY IN PHILADELPHIA.

Interesting Historical Sketch.

In the introductory portion of a paper on "The Development of Gaseous Fuel," read by Mr. Henry G. Morris before the Engineers' Club of Philadelphia, he gave the following interesting historical sketch of the gas supply of the city

The first record we have of the use of gas in Philadelphia is in 1796, when Michael Ambroise and Co., "Italian fire workers," had an amphitheatre for exhibitions. They displayed representations of temples. masonic emblems, &c., which they said were produced by "inflammable air with the assistance of light." In 1803, Mr. I. C. Henfrey made a proposition to the Councils to light the city by gas-lights burned in high towers.

In 1816, Dr. Charles Kugler exhibited at Peale's Museum, in the State House, "gas lights, lamps burning without wick or oil." This lighting took place in April, and was so satisfactory that Warner and Wood, of the new theatre, introduced the gas-lights at the fall season of the same year. William Henry, "coppersmith and tinsmith," constructed the apparatus for the use of the gas at the museum and theatre; and he was so well satisfied with the result of his work that he put up a gas apparatus in his own house, and invited the Councils to witness the effect. This was the first private dwelling illuminated by gas in the United States.

The Councils' Committee reported next year that they had examined the gas-lights at the museum and theatre, and while not taking any present action, recommended that a Standing Committee on Gas should be appointed to learn something more upon the subject, and report from time to time.

Peale continued to light his museum until the spring of 1818. His manufactory was in a small closet under the steps in the great hall leading to the upper floors of the State House building. Here he had a furnace and apparatus; but the establishment being considered dangerous, objection was made to its further continuance, and he thereupon ceased that method of illumination. The use of gas-lights in the Masonic Temple was brought to a close by the burning of the building in 1819. When the hall was rebuilt in 1822, new gas-works were erected, and permission was asked to extend pipes on to the streets to supply other consumers. But this privilege was refused by the

WILLEY & CO.
LIMITED,

RETORT WORK. INCLINES A SPECIALITY.

CONDENSERS, ANNULAR AND HORIZONTAL.

WASHERS, LIVESEY'S PATENT.

PURIFIERS AND VALVES
PICKERING'S PATENT.

STATION METERS AND GOVERNORS
SIMPSON'S PATENT.

GASHOLDERS
ANY SIZE.

SEND US YOUR ENQUIRIES.

WHY OPEN A LOT OF ACCOUNTS WHEN YOU CAN COME TO US FOR EVERYTHING, AND OBTAIN IT AT THE LOWEST PRICES?

Works: LONDON AND EXETER.

Councils, and predictions were freely made that gas as an illuminant would soon go out of use.

In 1825, an effort was made to induce the Legislature to incorporate the Philadelphia Gas Company, with authority to manufacture gas and lay pipes in the streets. The Councils were aroused, and the proposition was opposed. A writer in the "United States Gazette" denounced the project of lighting by gas to be "folly, unsafe, unsure, a trouble, and a nuisance."

From this time until 1831, various efforts were made to enlist the interest of the public; and in 1832 a Committee of the Councils was appointed to investigate and report. This they did the following year, with an estimate of the cost of gas for public lighting at $3·50 per 1000 cubic feet, exclusive of interest and salaries. In New York, at that time, gas was sold to citizens at $7 per 1000 cubic feet.

Finally, in extreme prudence, the Councils adopted the resolution that a person of scientific knowledge should be sent to Europe to examine into the methods of manufacturing gas there; and Samuel V. Merrick was entrusted with the duty. He returned in December, 1834, with a very favourable report.

In March, 1835, the Councils passed an ordinance appropriating $100,000 to construct works of 75,000 cubic feet daily capacity, on the site of the old Ninth Ward Gas-Works, which were finished and put into operation on Feb. 8. 1836.

Up to that time, there had been only 19 applications for private service. The price fixed was $3·50 per 1000 cubic feet, with a discount of 5 per cent. if paid within three days after presentation of the bill.

From this small beginning has grown the present gas-works of Philadelphia, having a daily output of 15 million cubic feet, with a constantly increasing demand, taxing the energies of those in control to keep pace with it.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

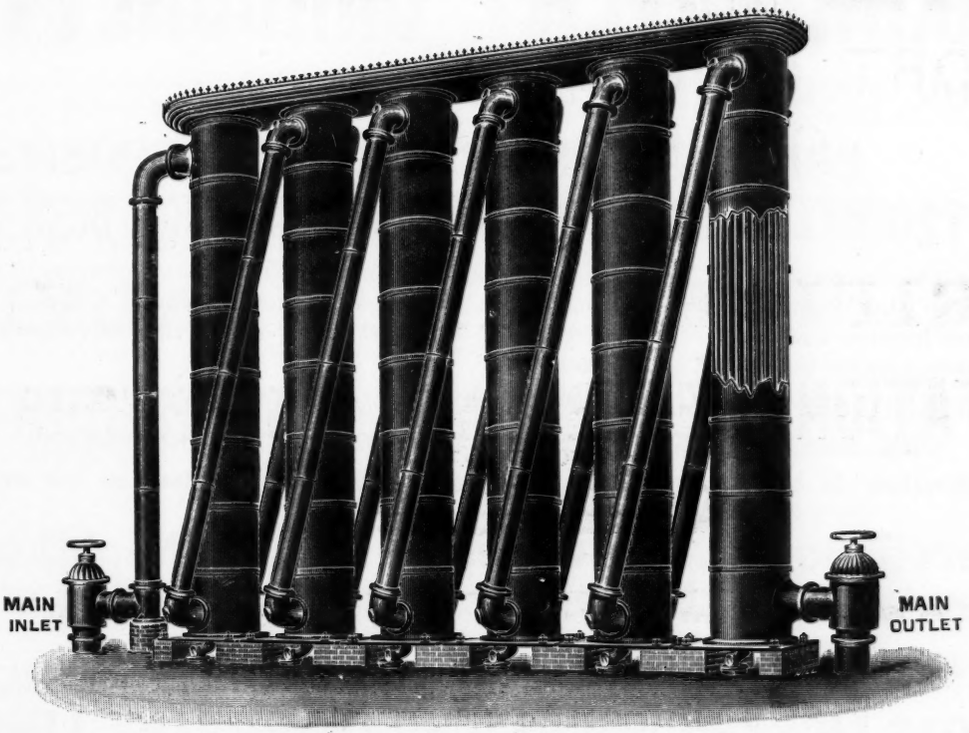
Saturday.

It would seem to be next to impossible to plant a gas-works anywhere without giving offence to somebody. The gas-works in Edinburgh have been for many years in a very densely populated locality; but they were people of the poorer classes, who did not complain much, although, undoubtedly, the works did frequently emit a not altogether pleasant, but at the same time by no means unhealthy, smell. Now that they have been removed to Granton, the population adjoining is sparse; but they are of the better classes, whose nostrils are more delicate than those of the coarser sort of people. This week correspondence has been going on in the columns of the "Scotsman" upon the subject, entirely, it is observable, by anonymous correspondents. The originator of the correspondence seemed to have some knowledge of the subject, for he was able to recall that, when the gas-works were about to be erected at Granton, "they were told that the methods adopted in Continental gas-works were far ahead of our methods; smoke and smell, too, were a negligible quantity, evidenced by the fact that some foreign gas-works have grounds with ornamental flower beds set in beautiful lawns." He complained that "very frequently the air all over Granton, Trinity, and Newhaven is polluted with an abominable smell coming from the gas-works. This has been going on for months." The next writer opined that "if the products from the manufacture of gas are being wasted by being dispersed over the surrounding country, then something must be wrong with the plant or the manner of working it. The collection and recovery of those 'waste products' was one of the chief reasons for the removal of the old works and the erection of the new works at Granton." But, he added that, residing in the pleasant and healthy suburb of Trinity, he had taken particular notice since the works were opened, and on no occasion had he been able to discover any appearance of smoke or the presence of odour from the new works. Other two writers, however, narrated a contrary experience; one of them asserting that the inhabitants of the district are complaining very loudly of the nuisance, and the other that the smells occur daily, and are the subject of conversation among ratepayers and others in the district. These letters, I have no doubt, will receive attention. It is not to be supposed that there is anything out of place in the Granton Gas-Works, or anything wrong in the method of working the plant there. Most probably the smells complained of are those arising when purifiers are changed; and in this connection it may be mentioned that the weather conditions have for months been favourable to the hovering about of vapours, and not to their dispersion. There is a feature of the works which may have a bearing upon this subject, although, from the careful way in which all objectionable effluents are gathered up and conveyed away to the sea, it is difficult to conclude that it has. This is the absence of a tall chimney. It is well known that the old high chimney in Edinburgh was erected because of the discharge of foul gases from the gas-works.

It is delightful to see how the Falkirk Town Council have settled down to the work of prosecuting the scheme for the erection of new gas-works. At a meeting of the Council on Monday, the Gas Committee reported that they had adopted the proposal of the Manager—Mr. W. M'Crae—to remove the gasholder from the Bleachfield site, and to reconstruct it on the new works at Thornhill when these are erected. They also reported that they have come to favourable terms with the North British Railway Company and the representatives of the Falkirk Iron Company as to the construction of railway facilities for the new works. Mr. H. Russell, the Convener of the Gas Committee, said, with regard to the gasholder, it would be by far the cheaper course to remove it than to keep it where it is. Although the holder was erected to contain 500,000 cubic feet of gas, they had never been able to utilize it for more than 150,000 feet. To make it sufficient for the requirements of the town would cost about £3600, and it would then have a storage capacity of about 450,000 cubic feet. But by spending £6500 to remove the holder, they would be able to get a storage capacity of 750,000 cubic feet; and they would not require to expend £15,000 upon the erection

CONDENSERS.

WATER COOLING.



ATMOSPHERIC.

C. & W. WALKER, LTD.,

Midland Iron Works: DONNINGTON, SALOP.
London Office: 110, CANNON STREET, E.C.

of another holder. The Council agreed to the recommendation of the Committee.

Mr. A. Yuill, the Engineer and Manager of the Dundee Corporation Gas Department, and Mr. G. Stevenson, the Convener of the Gas Committee, have returned from their visit of inspection of carburetted water-gas plants in England and Scotland. I imagine they did not see much of what they were in search of in Scotland, for the process has not been largely adopted in this land of rich and cheap coal. It is different in England; and there the deputation saw what pleased them, for Mr. Stevenson reported to the Gas Committee on Tuesday that the result of their inquiries was that where carburetted water gas had been adopted it had given satisfaction. In Liverpool, they found it was used to the amount of 50 per cent.; and in the other works visited the proportion ranges from 25 to 30 per cent. Mr. Stevenson also stated that in carburetted water gas there is 32 per cent. of carbon monoxide, while there is only 9 per cent. in Dundee gas, but that the opinion of those who use carburetted water gas is that it is not much more dangerous than is coal gas. The Committee instructed Mr. Yuill and Mr. Stevenson to write a report upon the subject, and to submit it to a future meeting of the Committee.

Replying to questions at a meeting of the Greenock Town Council on Tuesday, Mr. M'Onie said that nobody could deplore the low quality of gas more than he did. They were exceptionally desirous of improving the quality; but the stars in their courses were fighting against them. The recent addition to the works was acting very well, and the installation of retorts was also doing all that was expected of it. He assured the members that the work at the gas-works was engrossing more of his time and care than his own business.

A letter from the Stirling Gaslight Company was read at the Stirling Town Council this week, stating that the Company were willing to supply and maintain incandescent mantles in street-lamps wherever the Council had adopted, or were about to adopt, this form of lighting. The Council accepted the offer, and passed a vote of thanks to the Company. They also instructed the Burgh Surveyor to report as to where the lamps are proposed to be placed. This is a generous offer, the like of which might be made elsewhere.

The Kirkcaldy Gaslight Company, Limited, have a complaint against a gas collector in their employment named Thomas Condie Anderson. It is charged against him that he has embezzled sums amounting to £62 16s. 1½d, which he collected from a number of consumers of gas between May 31, 1902, and Jan. 7, 1904. Anderson was brought up in the Sheriff Court last Monday on the charge, and was remanded—bail being fixed at £100.

At two o'clock on Thursday morning, a 36-inch water-main burst at Garscube Bridge over the River Kelvin, at Maryhill, Glasgow. So great was the volume of escaping water, that it did much damage to the bridge, part of the wing wall of which required to be removed. There was great inconvenience in the northern parts of the city during the day, on account of the want of water. The main was repaired by the following day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 23.

Sulphate of Ammonia.

The market has been quiet throughout the week; and makers have had to accept slightly reduced prices in order to dispose of ready parcels. There has been a fair amount of direct inquiry; but buyers have not been urgent, and speculators who may have contracts for January delivery to cover seem to be waiting a better opportunity. The closing quotations are £12 15s. per ton f.o.b. Hull, and £12 16s. 3d. to £12 17s. 6d. per ton f.o.b. Liverpool and Leith. The forward position has attracted very little attention; and though £13 per ton might be accepted for delivery over the spring months, buyers do not respond at the price.

Nitrate of Soda.

This is quiet but firm; and spot prices remain at 9s. 9d. to 10s. per cwt., according to quality.

LONDON, *Jan.* 22.

Tar Products.

The markets all round are quiet, and there does not appear to be much doing. Pitch continues weak; and very low prices have been accepted on the Continent for forward delivery. There is a little more inquiry from South Wales; but the prices offered by consumers are very much under manufacturers' ideas, so that business is decidedly limited. Some quantity was, however, placed for the first six months of the year; but makers as a rule decline to quote over the whole year. It certainly seems as if prices were likely to go lower, at any rate for some little time, though there are several inquiries in the market for delivery all over next. Benzol is decidedly weaker, especially in the provinces, where business is reported in 90 per cent. at 10¼d. for prompt delivery. London makers are, however, still firm at 11d., though there are no buyers at this price. In 50-90 per cent., a little business is reported in the North at 7¾d. for February-March delivery. A small sale of toluol is reported at something under 8d.; but there is very little inquiry. Solvent remains in the same position. Prices have, however, a decided downward tendency, as there is more offering in the North of England. So far as London is concerned, prices of creosote are well maintained on account of the export demand; but in the North it is decidedly easier, and there is more offering, especially for early delivery. Carbolic acid continues firm; and the inquiry is very good, though prices do not improve. In crude, business has been done at from 1s. 6d. to 1s. 6¼d. for 60's, according to position; but makers as a rule hold off the market, believing in higher prices. In crystals, though there is very little business, there is a good inquiry; and should war actually break out, no doubt prices would improve. There is a fairly good inquiry for anthracene for delivery all over next year; but consumers will not pay prices asked

THE
MAXIM PATENT CARBURETTOR
FOR ENRICHING GAS IN BULK.
PREVENTS NAPHTHALENE DEPOSITS.
OVER 120 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
Among the Companies and Towns supplied are The Gaslight and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Oldham, Dundee, Perth, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Ten Years.
MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.
THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.
The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.
For Prices and full Particulars, apply to
THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

by makers. Some 40 per cent. "A" quality was sold last week at 2d. per unit; but the largest London makers as a rule ask 2½d. for delivery all over the year. Tar prices have a decided downward tendency; and competition is not likely to be anything like so keen in the future, as the recent heavy fall in pitch will deter tar distillers from paying the absurdly high prices for the raw material which ruled last year.

The average values during the week were: Tar, 20s. 6d. to 25s. 6d. Pitch, London, 36s. to 36s. 6d.; east coast, 34s. to. 34s. 6d.; west coast, 33s. to 33s. 6d. Benzol, 90 per cent., 10¼d. to 10¾d.; 50-90 per cent., 7¼d. to 7¾d. Toluol, 7½d. to 8d. Crude naphtha, 3¼d. to 3½d.; solvent naphtha, 9d. to 10d.; heavy naphtha, 11d. to 11½d. Creosote, London, 1¾d. to 1⅞d.; North, 1½d. to 1⅝d. Heavy oils, 2¼d. to 2½d. Carbolic acid, 60 per cent., 1s. 6d. to 1s. 6½d. Refined naphthalene, £5 to £7. Salts, 24s. to 26s. Anthracene, "A" quality, 1½d. to 2d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market is very firm indeed; and prices are well maintained. Beckton quote £13 for February-June; but have not yet made any sales at this price. The South Metropolitan report having sold for February at £13 2s. 6d., and now quote £13 3s. 9d. Very good business has been done at Hull at £12 15s.; and in one instance £12 16s. 3d. is reported to have been paid for early shipment. Makers at present decline to quote for forward; but £12 17s. 6d. may be taken as the nominal value for February-June shipment. From Leith several sales are reported at from £12 17s. 6d. to £12 18s. 9d.; and makers as a rule ask £13 for February-March shipment. Forward business is reported £12 10s. for October, 1904—March, 1905; but this must be of a purely speculative nature. The Liverpool market is very steady; and there is a good demand at from £12 15s. to £12 16s. 3d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

With the continued depression in the cotton trade, and the unsatisfactory position of the engineering and iron industries, the coal trade is just now largely dependent upon weather conditions for any briskness of demand; and these have so far not favoured any large requirements for house-fire consumption. As a result, collieries, notwithstanding it is now the middle of the winter season, are in a great many cases running short time—3½ to 4 days in isolated cases, and only in exceptional instances more than 4½ to 5 days per week. The output is ample for requirements; and quotations are not more than about steady at late rates. The curtailed output in house-fire coals is just moving away, and pit prices remain about 13s. 6d. to 14s. up to 15s. per ton for best qualities, 11s. and 11s. 6d. up to 12s. 6d. for seconds, and 9s. 6d. to 10s. 6d. for commoner sorts. The demand for common house-fire coals helps to maintain prices for steam and forge descriptions, which, although only meeting with an indifferent inquiry, still average from 8s. up to 8s. 6d. and 8s. 9d. per ton at the pit, according to quality. The position with regard to engine fuel varies considerably. Prices are about as last quoted; best descriptions ranging from 6s. 3d. to 6s. 6d. and 6s. 9d. per ton, medium sorts 5s. to 5s. 6d., and common qualities 4s. 3d. to 4s. 6d. and 4s. 9d. Shipping has fallen off during the past week or so; and prices for steam coals delivered at the Mersey ports scarcely average more than 9s. 3d. and 9s. 6d. to 9s. 9d. per ton.

Northern Coal Trade.

There is a steady, but barely a full, demand for coal; and with an ample production, the prices are for one or two classes a little easier. In steam coals, best Northumbrian kinds are quiet at about 9s. 4½d. per ton f.o.b. Second-class steams are quiet at 8s. 3d., and steam smalls are plentiful at from 3s. 9d. to 3s. 10½d. The want of a demand such as that known from the United States a year ago, is causing steam coals to be abundant, and at times easier in price. In the gas coal trade, there is still a full demand; and the deliveries on the large contracts take up most of the production—the prices quoted for occasional sales being from 8s. 3d. to 9s. per ton f.o.b. A number of contracts for coal for Continental gas-works are now being arranged—some for large quantities, for delivery over the season for shipping. It is probable that these will be arranged at prices from 6d. to 7½d. per ton below those of the past season; but the exact figure is made rather indefinite by the fact that many of the contracts are for coal delivered, and thus the varying freight influences the price. Gas coke is fairly taken up, and the price this week is unaltered.

Scotch Coal Trade.

There is still no improvement in trade; but the demand is steady, and coalowners are not without hope of better times. The output is large, and is being mostly taken up at home. The prices quoted are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 9d. to 9s. 6d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 186,890 tons—an increase of 77,909 tons upon the previous week, and of 15,494 tons upon the corresponding week of last year. For the year to date, the total shipments have been 322,077 tons—a decrease of 11,160 tons upon the same period of last year.

Opposition to the Crystal Palace Gas Company's Bill.—At the meeting of the Lewisham Borough Council on Wednesday, it transpired that the London County Council are convening a conference of the various public authorities affected by the provisions of the Bill promoted by the Crystal Palace District Gas Company, with the view to combined opposition. Delegates were appointed to attend the conference. At the meeting of the Lambeth Borough Council on Thursday, it was decided to oppose the reduction of the illuminating power of gas below 14 candles.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ltd.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract), 1,800,000 C. Ft. HAMILTON, ONT., 400,000 C. Ft.

Reduction in Price.—The Directors of the Brentford Gas Company have resolved to reduce the price of gas by 2d. after Lady-day next, making it 2s. 9d. per 1000 cubic feet.

Rejection of the Basingstoke Corporation Bill.—The statutory meeting of the ratepayers of Basingstoke was held a few days ago, to consider the Bill promoted by the Corporation to obtain powers for electric lighting, water supply, and other matters. The Mayor (Mr. R. S. Wallis) presided; and, having opened the business, left it to the Chairman of the Finance and General Purposes Committee (Mr. Allnutt) to put the case for the Bill, and propose a resolution sanctioning its promotion. When, however, it was submitted to the meeting, after some discussion, not a hand was held up in its favour. It was therefore declared to be lost.

Proposed Amalgamation of Southport and Birkdale.—A reply has been received by the Clerk to the Urban District Council of Birkdale and the Town Clerk of Southport to the effect that the Local Government Board had received the report made by their Inspector (Major C. E. Norton, R.E.), after the inquiry held by him last November, with reference to the representation of the Town Council of Southport in favour of the alteration of the boundaries of the borough so as to include therein the urban district of Birkdale. Having carefully considered the report, the Board do not regard the circumstances as such that they would be justified in granting a Provisional Order to give effect to the proposals contained in the representation. The result has been received with very much satisfaction by the residents in Birkdale.

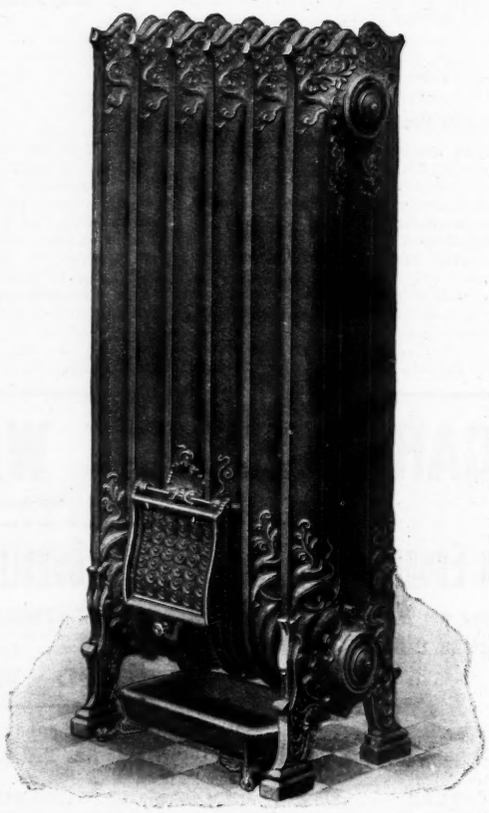
Proposed New Reservoir for Northallerton.—Colonel A. G. Durnford, R.E., one of the Local Government Board Inspectors, held an inquiry on Friday, at Northallerton, respecting the issue of a Provisional Order to the Urban District Council, giving them power to partially repeal, alter, or amend the Northallerton Water-Works Act, 1891, so as to enable them to construct a reservoir upon lands acquired, or to be acquired, under the powers of the Act. It is also proposed to reduce the pressure, and to borrow £1000. The Clerk to the Council said that, under the Act referred to, about 10 acres of land was acquired. About 15 million gallons of water were allowed for compensation purposes; and it was collected about 1½ miles from the service reservoir. This provided 300,000 gallons; but they were only allowed to bring 12,000 gallons per day—about two days' supply. It was considered advisable to have another service reservoir, and also to reduce the pressure. At the close of the inquiry, the Inspector drove to the gathering-grounds and works at Osmotherley.

Opening Roads and Alterations to Gas-Pipes.—At the meeting of the Lambeth Borough Council on Thursday, the Lighting Committee reported that it is the practice in the Engineer's Department to give notice to all the companies interested of any paving works which are contemplated in streets in which there are gas, water, or other mains, so that measures may, if necessary, be taken to remedy any defects which might be found. A letter had been received from the Chief Engineer of the South Metropolitan Gas Company (Mr. C. Carpenter) stating that he purposed extending this system, by sending a circular-letter to every consumer in a road which it is proposed to repair, inquiring whether the supply of gas is sufficient for all existing demands, and if there is a probability of an increased supply being required. The Committee added that this arrangement would, no doubt, commend itself to the members of the Council, as it would practically reduce to a minimum the number of openings to be made in the public thoroughfares in this Company's area of supply. The report was adopted.

Serious Gas Explosion at Scarborough.—Early on Monday morning last week, a labourer named James Nelson went to the new offices of Dr. Dittmar, the Medical Officer of Health for Scarborough, and proceeded to get them in order for the arrival of this official and his staff. The building is situated at the rear of the new Town Hall, and immediately overlooks St. Nicholas Gardens and the sea. It is a one-storey building, divided into three offices, and was occupied for the first time on the previous Thursday. From Saturday afternoon till the morning of the occurrence no one had been in the building, which was apparently left quite safe. It was evident, however, that during this time there had been a considerable escape of gas in the centre office. Nelson lighted the gas in the corridor and in the Doctor's room, and then opened the door of the centre office. As soon as he did so there was a violent explosion, which wrecked the building. The entire front was blown out and the other walls shattered. Nelson was found 50 yards away, in the gardens below. He was unconscious, and had received a number of cuts and bruises, and was burned about the ears and neck; but fortunately no bones were broken. He was speedily conveyed to the hospital, and on the way recovered consciousness.

Alderman Gibson on the Price of Gas in Manchester.—At a recent meeting of the Manchester Trades Council, a resolution was passed urging the Gas Committee of the Corporation to reduce the price of gas. In a letter to the Secretary acknowledging the receipt of the resolution, Mr. Alderman Gibson, the Chairman of the Gas Committee, wrote: "My past ten years' record of the administration of this department shows, I think, pretty clearly my desire to sell gas to all consumers at as low a price as possible; but so long as the City Council insist upon taking £50,000 a year out of the pockets of the gas consumers for what they call relief of the rates, so long shall I and my Committee be handicapped. The fact is, we are taking many hundreds a year out of the poor gas consumers' pockets and putting it into the pockets of large ratepayers who are rich and who do not use gas at all, but electricity. It is a monstrous robbery, and yet no one takes up that phase of the question at all. This clap-trap phrase of relieving the ratepayers is a popular term; but it is utterly at variance with the truth, and utterly fallacious. However, you may rest assured I shall do all I can in the direction your Committee advocates. At the same time, let me point out that we reduced the price 3d. per 1000 cubic feet last June, and since then we have abolished the charge for cookers. So we must see how this affects our income before we go any further."

PARKINSON'S NEW RADIATOR.



The "UNIVERSITY."

PARKINSON AND W. & B. COWAN, LTD.
(PARKINSON BRANCH),
LONDON AND BIRMINGHAM.

Chard Water Supply.—The question of the water supply, which has been under consideration for a very long time, was again discussed at the last meeting of the Chard Town Council. On the motion of Mr. Small, it was decided, by eleven votes to two, to rescind a previous resolution pledging the Council to carry out a gravitation scheme. The advocates of this change contended that it was desirable that the Council should have a free hand in the matter; while the opposition urged them to proceed with schemes already considered. It was, however, decided that the Water Committee should go into the whole question afresh, with power to consult Mr. Hodson, the Council's Engineer.

Unsatisfactory Electric Lighting at York.—Judging from statements which appear in the local Press, the York Electric Lighting Committee are having a somewhat uncomfortable time. Loud and repeated complaints are heard on all sides at the wretched condition of both the public and private electric lighting; and it is said that "the once brilliantly lighted shops are now dim with weary electric lamps, while those that have held fast to incandescent gas, and keep their mantles in good condition, stand out prominently as regards illumination." At the same time, it is admitted that the Committee have for long worked under extreme difficulty, due in large measure to the phenomenal growth of the undertaking.

Price of Gas in Southampton Out-Districts.—The Southampton Borough Council have agreed to memorialize the Gas Company to reduce the price charged in the added areas of the borough and Portswood, so as to make it the same as is paid by the town consumers. Under the Act of 1898, which authorized the Company to supply gas to the outlying districts as far as and including Eastleigh, they will be obliged to charge a uniform price after a lapse of ten years. It was pointed out by one member that, under the existing arrangement, in Commercial Street, one resident pays 2s. 10d. per 1000 cubic feet, another 3s. 4d. It is difficult to say how this seeming anomaly could be avoided. If there are to be separate charges for the inside and outside areas, there must be a firm boundary line somewhere.

Incandescent Gas Lighting in Marylebone.—Last Tuesday, the Lighting Committee of the Marylebone Town Council reported that they had approved of 51 streets and roads being lighted with 585 double, and 504 single incandescent gas-burners. The work would be begun on the 1st prox.; this being the date of the commencement of the contract with Messrs. Pontifex and Co. The cost of the installation will be as follows: Setting back and reinstating the paving for 1089 public lamps, at 20s. each, £1089; new lanterns fitted with single Kern burners, 504 at 37s. each, £932 8s.; do., fitted with double ditto, 585 at 52s. 6d. each, £1535 12s. 6d.; refuge lamps fitted with new lanterns and triple Kern burners, 57 at £7 7s. 6d. each, £413—total, £3970 0s. 6d. The Surveyor reported that the Kitson lamps in Portland Place had been removed.

Alderman Lowden on the Gas Policy at Leeds. — Alderman J. Lowden, the Chairman of the Leeds Gas Committee, was one of the speakers on Monday night of last week in connection with a bye-election in the Armley Ward; and, not unnaturally, he referred with some pride to the success which had attended the progressive policy adopted by the Gas Department, under the management of Mr. R. H. Townsley. Dealing with the gas-workers' wages question, he declared that since his party came into power there was not a man in the employ of the department who had not either had his hours of labour reduced or his wages increased. He believed that at the end of the financial year the department would show a record profit, legitimately made, to go towards the relief of the rates. Considering this satisfactory state of things, they hoped shortly to reduce the price of gas.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., on Tuesday, Mr. Alfred Richards placed, by order of the Directors, a new issue of 5 per cent. perpetual debenture stock of the Croydon Gas Company at £124, £124 10s., and £125 per £100 of stock. On the same occasion, a new issue of 400 ordinary £10 shares (last dividend on similar shares 5¼ per cent.), as well as £1000 of 4 per cent. perpetual debenture stock of the Lowestoft Water and Gas Company, was sold—the former at prices ranging from £11 5s. to £11 10s. each, and the latter at £105 10s., £106, and £106 10s. per £100 of stock. Some £10 fully-paid shares in the Barking Gas Company, carrying a dividend of 7 per cent., fetched £13 5s. each. At Canterbury, the next day, Messrs. E. & G. Hobday sold £238 of "A" stock and £1140 of "B" stock of the Canterbury Gas and Water Company. The stocks were offered in £20 lots; and the prices realized ranged from £36 10s. to £38 5s.; the greater part fetching £36 10s. and £36 15s. Last Thursday, 2000 new ordinary £5 shares in the Portsmouth Water Company were disposed of by Messrs. Ernest Sapp and Co. It was the sixth sale under the Company's Provisional Order of 1902, and there was a large attendance. The highest price reached was £6 10s., and the lowest £6 5s. per share; but the majority were sold at £6 7s. 6d. each.

New Joint-Stock Companies.—The Graham Lighting Company, Limited, has been registered with a captital of £5000, in £1 shares, to acquire the concern conducted by Messrs. C. Graham and W. Hotton under the name of the Graham Lighting Company, and to carry on the business of gas engineers and specialists, fitters of, and dealers in, gas and other lamps, electricians, plumbers, gas-fitters, gas-mantle manufacturers, manufacturers of incandescent burners, anti-vibrators, gas-brackets, and other gas or electrical fittings, &c. Edmundson's Furnishing and Engineering Company, Limited, has been registered with a capital of £18,500, in 3700 shares of £5 each, for the purpose of acquiring and taking over as a going concern the undertaking of Edmundson's Furnishing and Engineering Company, Limited, of Dublin, who are owners of gas-works at Westport and Carrick-on-Shannon. Among the first Directors are Messrs. J. R. Wigham, J. W. Edmundson, W. R. Wigham, and Bernard Wigham. The Empire Intensified Gas-Light Company, Limited, has been registered with a capital of £25,000, in £1 shares, to adopt an agreement with the Somzée-Greyson Intensified Gas-Light Syndicate, Limited, and the Liquidator thereof, to manufacture and deal in burners, lamps, gas-mantles, glasses, gas-compressing machinery, &c., and to carry on the business of suppliers of heat or power by gas, electricity, or otherwise. There will be no initial public issue.

COMPLETE

SLOT

INSTALLATIONS.

COOKERS

METERS

PENDANTS

PIPING

LABOUR SUPERVISION

WE

Provide and fix Complete Installations, including Stove, Meter, and Fittings at an Agreed Price: Payment spread over a number of years, if desired.

——Gas Company.

"I have pleasure in stating that the fitting up of 670 Cookers which you undertook to carry out last year on behalf of my Company has given us the utmost satisfaction. The workmanship was excellent, and the attention on the part of your foreman left nothing to be desired."

"I also have very much pleasure in testifying to the good results which accrued from your canvas of our consumers."

RICHMOND'S.

Carpenters Road, Stratford. Academy Works, Warrington.

Electric Light at Hartlepool.—The electric light, which has just been installed at Hartlepool, was switched on last Friday by the Mayor (Mr. J. R. Butterwick), in the presence of a large gathering of members of the Town Council and others. The service has been provided by the Northern Counties Electricity Supply Company, to whom the Corporation transferred their rights under parliamentary powers obtained some years ago.

Pudsey Gas Company.—The report of the Directors of the Pudsey Gas Company for the year ending Dec. 31 last shows that the consumption of gas has been 1·21 per cent. less in quantity—the decrease being due to depressed trade and the extended use of incandescent burners. The Company have reduced the rental of meters; and the loss by this action amounts to £230 per annum. The total sale of gas to private consumers during the year was 118,585,500 cubic feet; and for public lighting and under contract, 8,357,700 cubic feet.

Coventry Water Supply.—At the meeting of the Coventry Town Council on Tuesday, Alderman Bird moved the following recommendation from the Water-Works and Fire Brigade Committee: "That application be made to the Local Government Board, under the provisions of the Coventry Water Order, 1903, for sanction to a loan of £15,000, to be applied in payment of the balance of the purchase-money of the undertaking of the North Warwickshire Water Company, which was advanced out of revenue, the costs of the arbitration of the Company, the costs of the connection of the Company's mains with the Corporation system, and the general purposes of the water undertaking." This amount, he said, would probably not meet the requirements for more than two or three years, as no large town in England was developing so much as Coventry, particularly in the outlying districts where the mains referred to were required. The recommendation was adopted.

Carnarvon and the Electric Light.—Some unexpected developments have occurred in connection with the efforts of the Carnarvon Corporation to decide upon a scheme of electric lighting, the National Wiring Company having served a writ upon them for an alleged breach of contract. A meeting of the Town Council took place last Friday, when it was reported that the Council in committee, at a previous meeting, had instructed the Town Clerk to accept service and to enter a defence, and also to obtain the advice of Mr. Bryn Roberts, M.P. Since this meeting, representatives of the Electric Lighting Committee have discussed with Mr. Bryn Roberts the question of the Council's liability under the sealed agreement of June last. Counsel's opinion was that the Council's contention that there was no binding contract was legally unassailable; but he advised that a deputation of the Council should meet representatives of the Company, and treat with them for the payment (without admitting liability) of out-of-pocket expenses incurred by the Company. The action of the Committee was confirmed.

At their meeting on Monday last week, the Driffield District Council increased from 20 to 25 per cent. the discount on the charge for gas used for power purposes.

Messrs. E. Padfield and Co. have recently received orders to supply two of Atterton's patent charging machines to the Fleetwood Gas-Works, and one each to St. Anne's-on-Sea and Whitworth Vale.

The Bournemouth Gas and Water Company, as will be seen by an announcement in our advertisement columns, are inviting tenders for an issue of 1000 £10 7 per cent. "B" shares. The minimum price of issue has been fixed at £15 per share.

Messrs. Hanna, Donald, and Wilson, of Paisley, have just completed a large gasholder with steel tank for the St. Andrews Gas Company, and also a similar one for the Bridge of Weir Gas Company. Both holders are prepared for telescoping.

The Portsea Island Gaslight Company have placed an order for twenty inclined retort-arches, five beds of nine and five beds of eight 20 feet inclined retorts complete, for their new Hillsea works, with Messrs. Gibbons Bros., Limited, of Dudley. The work is to be carried out to the design, and under the superintendence, of the Company's Engineer, Mr. J. W. Ashworth.

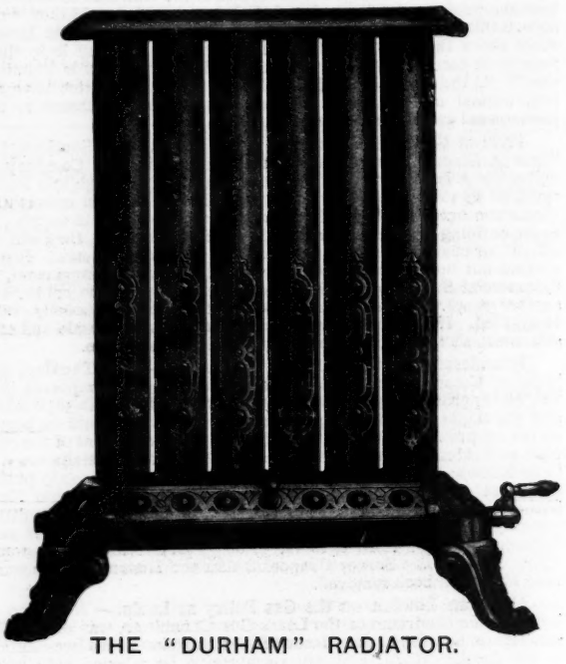
The deepest artesian boring put down in New South Wales last year was at Careunga—4080 feet. The additional artesian supply tapped during the year amounted to 17 million gallons per day. The Municipal Engineer of Rangoon having suggested that the water supply of the town should be increased by sinking two fresh tube-wells, a sum of 12,000 Rs. has been sanctioned for the purpose.

The Eastbourne "New Congregational Church Monthly Magazine" states that the church, which was opened a few weeks ago, is lit by means of "Bijou" inverted incandescent lamps, with which less than 100 cubic feet of gas per hour is required to effectively illuminate the building. For heating purposes, six "Neptune" hot-water gas-heated radiators have been fixed; while the vestries are equipped with gas-fires, and the school and other rooms are fitted with ordinary incandescent burners. The Gas Company are to be congratulated upon having had so good an opportunity of showing what they can do in the way of up-to-date lighting and heating. The installation is stated to have been a great success.

The report of the Directors of Tubes Limited states that the accounts for the year ending the 30th of September show a net trading profit of £7501, which compares with a trading loss of £26,304 for the previous year. This improvement was caused in part by a considerably increased output, but chiefly by saving effected in cost of manufacture. Besides £6200 spent out of revenue on renewals and repairs to plant and in the maintenance of property, the sum of £2508 has been expended on new machinery, and charged to capital account. The Directors are, however, under present circumstances, unwilling to show any increase in the statement of capital value of the plant, and, with the consent of the Valuer, have written off the cost of these additions out of the profits of the year under review.

The "MAIN"

GAS-FIRES.



THE "DURHAM" RADIATOR.

THE "MELROSE" FIRE.

R. & A. MAIN, LTD.,

London, Glasgow, Falkirk.

The works of the James Keith and Blackman Company, Limited, in Arbroath, have been largely reconstructed during the past year. They cover about an acre of ground, and for future developments, another site, extending to about the same size, has been secured. There is a frontage, built of red sandstone, of massive proportions, and almost without windows. This style of building has been adopted to avoid glare from the moulding-shop being projected into the principal street of the town. In front of the office a Keith lamp of 2000-candle power, supplied with compressed gas, has been erected, while in a window above, for the lighting of the show-room, a large Blackman fan, studded with coloured electric lamps, slowly revolves. The works are profusely fitted with ventilating fans, driven by electricity; but all the lighting in them is by gas—the Keith system being largely used. The business was founded in 1823 by the grandfather of Mr. James Keith, Assoc.M.Inst.C.E., the present Engineer-in-Chief and Managing-Director of the Company; and the concern has developed from a small plumbing and brass-founding business into a great engineering establishment employing about 200 men.

We have received from Messrs. Hazell, Watson, and Viney Limited, a copy of "Hazell's Annual" for the current year. This useful work, which has now nearly attained its majority (the present being the nineteenth issue), has become an indispensable companion to the other books of reference with which well-conducted offices are furnished; and the one before us has been brought by the Editor (Mr. W. Palmer) quite up to date by the inclusion of events which occurred within a week of its publication. There are two special features of the "Annual" to which attention may be directed. In the first place, in response to a very general request, a full index has been prepared; the original alphabetical arrangement of the articles being, however, continued. The other feature is a consolidation and classification of the articles. This is particularly noticeable in those dealing, among other subjects, with "The British Empire," "Parliament," "The Fiscal Question," "Scientific Progress," and "The Weather,"—the last-named subject being made specially interesting by some tables furnished by Mr. W. Napier Shaw, M.A., the Secretary of the Meteorological Office. The real value of such a work as the "Annual" lies, of course, in the reliability of the information contained in it. Every year, however, the assistance of Government and other officials is, the Editor states in his Preface, most generously given in the revision of the matter; and therefore he submits the combined results of his own and their labours with confidence that they will be found trustworthy.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ASSISTANT MANAGER. Heckmondwike Gas-Works. Feb. 11.
DRAUGHTSMEN (Two). No. 4154.
HANDY MAN. Paignton Gas-Works.
HANDY MAN. Ware Gas-Works.
SULPHATE MAKER AND MAIN LAYER. No. 4155.
MAIN AND SERVICE LAYER. Merthyr Tydfil Gas-Works.

Situations Wanted.

SHOW-ROOM MANAGER OR CLERK. No. 4153.
STOKER. Harvey, Ipswich.

Plant, &c., for Sale.

CONDENSER (250,000 feet). Redditch Gas-Works.
EXHAUSTERS, ENGINES, BOILERS, TAR AND LIQUOR TANKS, COAL TRUCKS, BARROWS, TAR EXTRACTOR, SCRUBBERS, PURIFIERS, &c., &c. Gaslight and Coke Company. Tenders by Feb. 11.
WASHER-SCRUBBER. Alloa Gas Department.

Plant, &c. (New or Second Hand) Wanted.

GAS METERS. No. 4156.
PURIFIERS. North Ormesby Gas-Works.

Company Meetings.

CRYSTAL PALACE DISTRICT GAS COMPANY. Albion Tavern. Feb. 12. Three o'clock.
GASLIGHT AND COKE COMPANY. Chief Office. Feb. 5. Twelve o'clock.

Sales of Stocks and Shares.

BOURNEMOUTH GAS AND WATER COMPANY. Feb. 11.
SOUTH ESSEX WATER COMPANY. Feb. 2.
WREXHAM AND EAST DENBIGHSHIRE WATER COMPANY. Feb. 8.

TENDERS FOR

Brass Fittings.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

Coke.
ABERYSTWYTH GAS COMPANY.

Fire Hydrants, Stop-Cocks, Sluice Valves, &c.
PLYMOUTH WATER DEPARTMENT. Tenders by Feb. 11.

Ironmongery.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

Iron Work (Cast).
PLYMOUTH WATER DEPARTMENT. Tenders by Feb. 16.

Lead and Lead Pipe.
PLYMOUTH WATER DEPARTMENT. Tenders by Feb. 16.

Lime.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

Oxide of Iron (Spent).
HAGUE GAS-WORKS.

Pipes, &c.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

Pumping Machinery, &c.
CHELMSFORD CORPORATION. Tenders by Feb. 20.

Purifiers (New or Second Hand).
NORTH ORMESBY GAS-WORKS.

Sulphuric Acid.
HERNE BAY GAS AND COKE COMPANY.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

Tar.
HERNE BAY GAS AND COKE COMPANY. Tenders by Feb. 6.
NELSON GAS DEPARTMENT. Tenders by Feb. 16.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 202.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	12½—13½	..	5 11 1
200,000	5	Nov. 12	6½	Bombay, Ltd.	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Aug. 13	12	Brentford Consolidated	228—233	..	5 3 0
300,000	,,	,,	9	Do. New	171—176	..	5 2 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	130—135	..	3 14 1
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	103—108	..	3 14 1
220,000	Stk.	Sept. 11	10½	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7½	Do. A. Ord. Stk.	145—150	..	5 3 4
460,000	20	Oct. 15	10	British	38½—39½	..	5 1 3
100,000	Stk.	Aug. 13	6	Bromley, Ord. 5 p.c.	115—120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	88—93	..	4 16 9
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd	10½—11	..	6 7 3
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
150,000	20	July 10	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Aug. 27	5⅝	Commercial 4 p.c. Stk.	104—107	..	4 17 3
503,750	,,	,,	5	Do. 3½ p.c. do.	98—101	..	4 19 0
442,947	,,	Dec. 11	3	Do. 3 p.c. Deb. do.	84—87	..	3 9 0
800,000	Stk.	Dec. 30	7	Continental Union, Ltd.	115—120	..	5 16 8
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—135	+2	5 3 8
375,000	Stk.	Aug. 27	5½	Crystal Palace Ord. 5 p.c.	110—115	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	118—123	..	4 1 4
112,533	,,	Jan. 14	5	Do. 5 p.c. Deb. Stk.	134—137*	..	3 13 10
486,090	10	July 29	10½	European, Ltd.	18½—19½	..	5 7 8
354,060	10	,,	10⅝	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Aug. 13	4⅛	Gas-light and Coke Ord.	89—91	+2	4 16 8
2,600,000	,,	,,	3⅛	4 p.c. Ord.	89—91	+2	4 16 8
3,799,735	,,	,,	4	3½ p.c. max.	88—90	+1	3 17 9
4,193,975	,,	Dec. 11	3	and 4 p.c. Con. Pref.	107—110	..	3 12 9
258,740	Stk.	Sept. 11	5	Coke 3 p.c. Con. Deb.	85—87	..	3 9 0
70,000	10	Oct. 15	11	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
3,800,000	Stk.	Nov. 12	10	Hongkong & China, Ltd.	16—17	..	6 9 5
473,600	Stk.	Aug. 13	3½	Imperial Continental	198—201	+1	4 19 6
165,242	Stk.	Aug. 27	6	Do. 3½ p.c. Deb. Red.	98—100	..	3 10 0
561,000	Stk.	,,	10	Lea Bridge Ord. 5 p.c.	113—118	..	5 1 8
718,100	,,	,,	7	Liverpool United A	214—216	..	4 12 7
306,083	,,	Dec. 30	4	Do. do. B	162—164	..	4 5 4
75,000	5	Dec. 11	5	Do. do. Deb. Stk.	108—110	..	3 12 9
560,000	100	Oct. 1	5	Malta & Medn., Ltd.	4½—4⅝	..	5 5 3
250,000	100	,,	4½	Met. of 5 p.c. Deb.	101—105	..	4 15 3
541,920	20	Nov. 12	3½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
1,515,892	Stk.	Aug. 13	4½	Monte Video, Ltd.	9—10	..	7 0 0
376,855	Stk.	Dec. 31	3½	Newc'tle & G'tesh'd Con.	105—107	..	4 4 1
300,000	Stk.	Nov. 26	8	Do. 3½ p.c. Deb.	94—95	..	3 13 8
600,000	5	Sept. 30	7	Oriental, Ltd.	135—140	..	5 14 4
				Ottoman, Ltd.	5—6	..	5 16 8
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	Jan. 14	6⅛	Ply'mth & St'house 5 p.c	121—126*	..	4 17 2
851,070	10	Oct. 15	7	River Plate Ord.	11—11½	..	6 1 9
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
250,000	10	Sept. 30	8	San Paulo, Ltd.	10½—11½	..	6 19 2
135,000	Stk.	Sept. 11	10	Sheffield A	240—242	..	4 2 8
209,984	,,	,,	10	Do. B	240—242	..	4 2 8
523,498	,,	,,	10	Do. C	239—241	..	4 3 0
116,106	Stk.	Sept. 30	5	Shrewsbury Ord. 5 p.c.	103—112	..	4 9 3
6,150,000	Stk.	Aug. 13	5⅛	South Met., 4 p.c. Ord.	118—121	+1	4 8 2
1,780,000	,,	Jan. 14	3	Do. 3 p.c. Deb.	84—87*	..	3 9 0
380,940	Stk.	Nov. 12	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	Jan. 14	4	Do. 4 p.c. Deb.	100—103*	..	3 17 8
120,000	Stk.	Aug. 27	6	Tottenham and Edmonton A. 5 p.c.	115—120	..	5 0 0
313,020	,,	,,	4⅛	Tottenham and Edmonton B. 3½ p.c.	95—100	..	4 10 0
182,380	10	Dec. 30	8	Tuscan, Ltd.	8—9	..	8 17 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	57—59	..	5 1 0
737,142	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.	96 59	..	5 1 0
				WATER COMPANIES.			
781,517	Stk.	Dec. 30	12	Chelsea, Ord.	310—320	+2½	3 15 0
150,000	,,	,,	5	Do. 5 p.c. Pref.	140—145	..	3 9 0
160,000	,,	,,	4⅛	Do. 4⅛ p.c. Pref. '75	130—135	..	3 6 8
175,785	,,	Sept. 30	4⅛	Do. 4⅛ p.c. Deb.	152—137	..	3 5 8
1,720,560	Stk.	Oct. 15	8	East London, Ord.	220—225	+2	3 11 1
654,740	,,	Dec. 11	4⅛	Do. 4⅛ p.c. Deb.	133—138	..	3 5 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	87—50	..	3 6 8
700,000	50	Dec. 11	10	Grand Junction 10 p.c. max.	135—138	+1	3 12 6
310,000	Stk.	Sept. 30	4	Grand Junction 4 p.c. Deb.	115—120	..	3 6 8
708,000	Stk.	Aug. 13	10	Kent	290—300	..	3 6 8
160,000	,,	,,	7	Do. New, 7 p.c. max.	195—205	..	3 8 4
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max.	290—300	+5	3 13 4
406,200	100	,,	8⅛	Do. 7⅛ p.c. max.	215—225	..	3 15 7
350,000	Stk.	Sept. 30	4	Do. 4 p.c. Deb.	115—120	..	3 6 8
500,000	100	Aug. 13	12⅛	New River, New Shares	310—320	+5	4 0 0
1,000,000	Stk.	July 29	4	Do. 4 p.c. Deb.	115—120	..	3 6 8
902,300	Stk.	Dec. 30	7⅛	South-wark and Vauxhall Ord.	245—255	+4½	2 18 10
126,500	100	,,	7⅛	South-wark and Vauxhall 7⅛ p.c. max.	200—210	..	3 11 5
489,200	Stk.	,,	5	South-wark and Vauxhall 5 p.c. Pref.	142—147	+2	3 8 0
1,019,585	,,	Oct. 15	4	Vauxhall 4 p.c. A Deb.	115—120	..	3 6 8
1,155,066	Stk.	Dec. 11	10	West Middlesex	290—295	..	3 7 9
200,000	,,	,,	4⅛	Do. 4⅛ p.c. Deb.	130—135	..	3 6 8
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb.	88—91	..	3 5 11
				* Ex div.			

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in Advance.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1904, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

SULPHATE OF AMMONIA

SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.

BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,

VICTORIA PAINT WORKS, MANCHESTER.

Telegrams: "ENAMEL." National Telephone 1759.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.

Apply to E. PADFIELD AND CO., 96 & 98, Leadenhall Street, LONDON, E.C.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS

PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.

Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses: "Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.

General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.

SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."

Telephone: 341 AVENUE.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

SITUATION WANTED AS STOKER.

WANTED, a Situation as Stoker, in small or medium-size Gas-Works. Shovel charging preferred.

Address E. HARVEY, 37, Wykes Bishop Street, IPSWICH.

TO GAS MANAGERS.

A YOUNG Man, 25 Years of Age, at present engaged in a large Gas Stove and Lighting Works, is desirous of meeting with a position as SHOW-ROOM MANAGER or CLERK.

Conversant with requirements of both company and consumer.

Previous to present berth, was Five Years Show-Room Salesman and Clerk in a large and progressive gas company.

Satisfactory Reference, &c.

Address No. 4153, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Two competent and experienced DRAUGHTSMEN accustomed to Structural Steel Work, Roofs, and Gas-Works Construction.

Apply, by letter, to No. 4154, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, a Smart All-round HANDY MAN, used to fitting in compo, brass, or iron. Quick at Slot Work, fixing Meters, Stoves, and Main and Service Laying. Able to do all Repairs on Works, including rough Smith Work, and accurate in reading Meters. Must be reliable and steady. Abstainer preferred. Age about 30. Wages 6d. per hour. References only required. Men not used to above work need not apply.

State Age, and whether Married or Single, to MANAGER, Gas-Works, Paignton, SOUTH DEVON.

WANTED, at once, a smart all-round HANDY MAN, used to fitting in Compo., Brass, or Iron. Quick at Slot Work, fixing Meters, Stoves, and Main and Service Laying, able to do all repairs on Works, including rough Smith work, and accurate in reading Meters. Must be reliable and steady. Abstainer preferred. Age about 30. Wages 30s. per week. References only required. Men not used to above work need not apply.

State Age, and whether married or single, to the MANAGER, Gas-Works, Ware, HERTS.

OXIDE OF IRON.

(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL, 5, CROOKED LANE, LONDON, E.C.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, LIMITED, Tar Distillers, Sharpness Docks, GLOS.

WANTED, by the Merthyr Tydfil Gas Company, a steady reliable MAIN and SERVICE LAYER. Constant employment to a suitable man. Wages 28s. per week.

Applications and Testimonials to the undersigned.

JAMES E. KENSHOLE, General Manager.

Gas Offices, Merthyr Tydfil, Glamorganshire, Jan. 12, 1904.

WANTED, a competent and experienced WORKMAN who thoroughly understands the Manufacture of Sulphate of Ammonia, also Main and Service Laying. Constant employment to good man.

Apply, by letter, to No. 4155, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HECKMONDWIKE GAS COMPANY.

AN Assistant-Manager wanted for the above Works, making rather over 100 Million cubic feet of gas per Annum.

Candidates must possess a thorough knowledge of Gas Manufacture and Distribution, and be experienced in the working of both Inclined and Horizontal Retorts, with a knowledge of Chemistry and Gas Analysis, the preparation of Drawings and Specifications, and fully qualified to take entire charge of the Works in the absence of the Manager.

Applications, stating Age, Experience, and Salary required, accompanied by *copies* only of not more than three recent Testimonials, and marked on the envelope "Assistant Manager," to be addressed to the Chairman of the Company, as under, not later than Thursday, the 11th of February, 1904.

JOSEPH STEAD, Ashfield Villa, Heckmondwike.

WANTED, Second-hand Gas-Meters, from 2-lights up. State Condition and Price. Any number taken.

Address No. 4156, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Set of four Purifiers, New or Second-Hand, each about 14 ft. by 14 ft. by 5 feet deep, lutes or luteless, with 15-inch dry Centre Valve and Connections.

Prices, erected on the Works complete, addressed to T. WEATHERLY, Secretary, Gas-Works, North Ormesby, near MIDDLESBROUGH.

CONDENSER for Sale. In splendid Condition. Cheap. Capacity 250,000 Cubic Feet per Twenty-four hours.

Apply to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

SPENT OXIDE OF IRON.

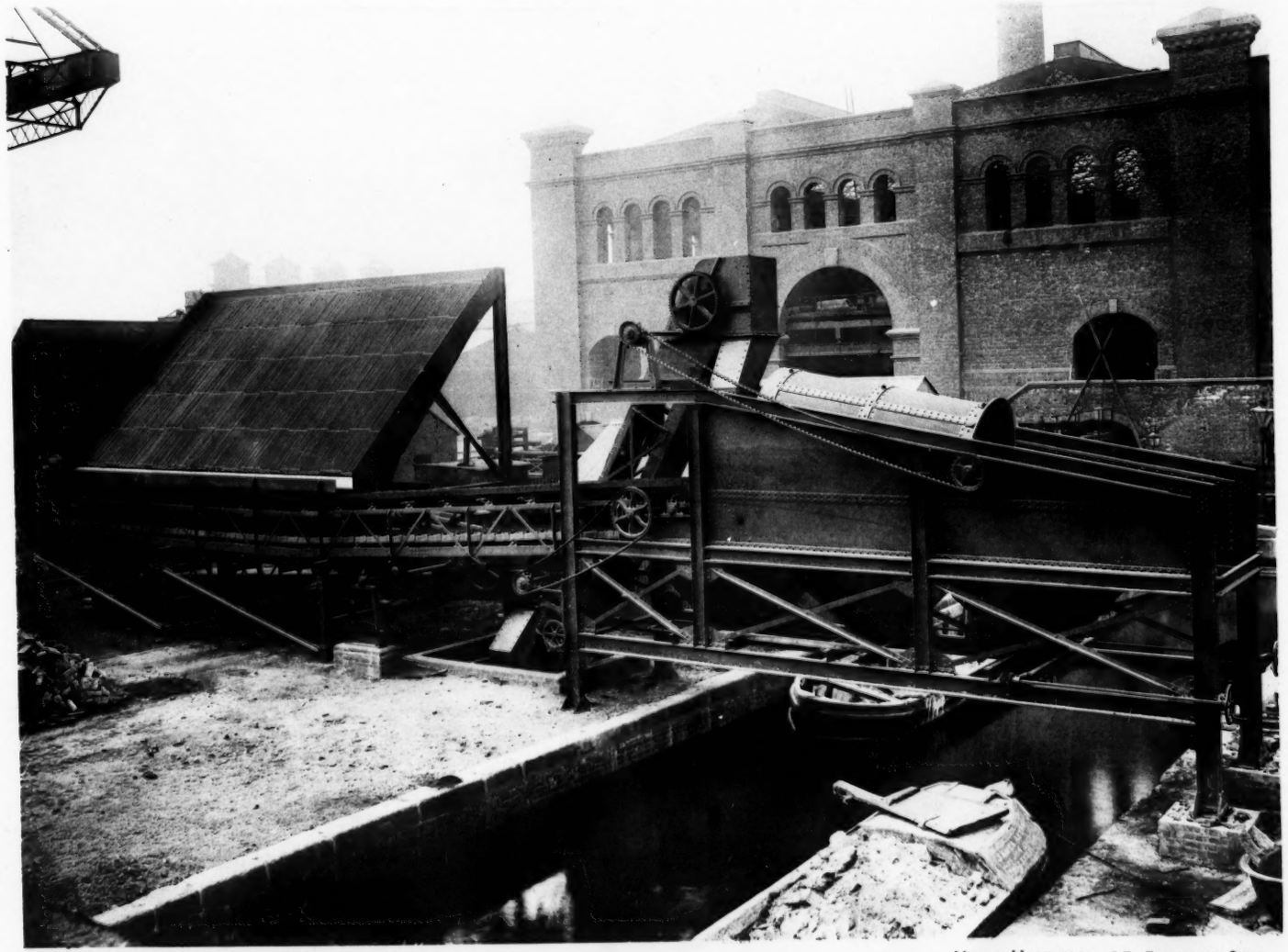
FOR SALE—500 Tons of Spent Oxide of IRON, containing about 50 per cent. of Sulphur.

Delivery before May, 1904, f.o.b. Rotterdam or Amsterdam.

Tenders invited by the Manager, and are to be addressed to the DIRECTION OF THE MUNICIPAL GAS-WORKS The Hague, HOLLAND.

TAR Contracts Wanted on the Sliding-Scale or at Fixed Prices.

Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.



Birmingham Corporation Gas Dep$^{t.}$ Henry Hack, M.Inst.C.E., Engineer-in-Chief.

COKE SCREENING PLANT FOR LOADING CANAL BOATS AT SALTLEY GAS WORKS,
MADE AND ERECTED IN 1903 BY

ROBERT DEMPSTER & SONS L$^{TD.}$, ELLAND, YORKS.

Printed for Walter King, by King, Sell & Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Jan. 26th, 1904

Collotype by Waterlow & Sons Ltd.

The Directors and some of the Managers of WILLEY & Co., - Limited. -

John Grafton,
Constructional Foreman.

William James Jackson,
Councillor. Manager Iron Foundries.

John Bates,
Councillor. Manager Brass Foundries.

William Sellers Pickering, A.M.I.M.E.,
Inventor of "Pickering" Valve.
Deputy Engineer.

Henry Wendt Loram,
Labour Leader, and Chief of the
Pattern Departments.

John Noak,
Erecting Foreman.

Stephen Simpson, A.M.I.M.E.,
Director. Inventor of Slot Meter.
Controller Brass Fitting Department.

George Weslake,
Director. Meter Manager.

Thomas Glanfield
Secretary.

Henry Alfred Willey, A.M.I.C.E.,
Chairman and Managing Director.

Harry Grove, A.M.I.M.E.
Chief Engineer.

Frederick Templer Depree, J.P.,
Director. Councillor & Magistrate. Goldsmith.

Sydney J. H. Willey,
Director. Metropolitan Representative.

Thomas Hammond, A.I.E.E.
Chief Electrical Engineer.

Reginald J. Rew, A.M.I.M.E.,
Engineering Representative

Fred Blanchford,
Manager Stove Dept.

George Lane
Chief Clerk.

Harry Weslake,
Deputy Meter Manager.

Ernest F. Underhill,
West of England Representative.

LONDON & EXETER.

JANUARY, 1904.

Printed for WALTER KING, by King, Sell, and Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Jan. 26, 1904.

WASHER-SCRUBBER FOR SALE.

THE Alloa Gas Department have for disposal, one "Walker" PURIFYING MACHINE with WASHER, capacity 500,000 cubic feet per Twenty-four Hours. In good condition. Replaced by larger machine.

Offers to J. W. NAPIER, Manager, Corporation Gas-Works, ALLOA.

TO BE SOLD — Twin-Cylinder Gas- ENGINE, 6 n.h.p., by Crossley; Cylinders 8 in. diameter by 18 in. stroke, and Gas-Bag.

NEW GASHOLDER SHELLS, 40 feet diameter by 12 feet deep, and 50 feet diameter by 15 feet deep, with or without New Steel Tanks and Standard Guides.

Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

ABERYSTWYTH GAS COMPANY.

THE Directors of the Aberystwyth Gas Company invite TENDERS for the surplus COKE which they have for Sale.

For Particulars, apply to

R. J. JONES,
Secretary.

HERNE BAY GAS AND COKE COMPANY, LIMITED.

SULPHURIC ACID.

THE Directors of this Company are prepared to receive TENDERS, on or before Saturday, the 6th of February prox., for the supply of about 40 Tons of SULPHURIC ACID, to be delivered during the Year 1904.

Particulars of Contract and Form of Tender to be obtained from the Secretary, at 6, Bream's Buildings, Chancery Lane, London, E.C.

The Directors do not bind themselves to accept the lowest or any Tender.

H. E. NEWTON,
Secretary.

Jan. 25, 1904.

HERNE BAY GAS AND COKE COMPANY, LIMITED.

TAR.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR produced at their Works at Herne Bay, Kent, 'om Jan. 1 to Dec. 31, 1904.

It is estimated that the quantity will be about 5,000 Gallons.

Particulars of Contract and Form of Tender to be obained from the Secretary, at 6, Bream's Buildings, Chancery Lane, London, E.C.

Tenders, quoting Prices free on Rail and in Barge in purchasers' own casks, to be sent in on or before Saturday, the 6th of February, prox.

The Directors do not bind themselves to accept the highest or any Tender.

H. E. NEWTON,
Secretary.

Jan. 25, 1904.

PLYMOUTH CORPORATION WATER-WORKS.

TENDERS are invited for the supply of the following GOODS and MATERIALS for a period of One Year:—

FIRE HYDRANTS,
LEAD PIPE and PIG LEAD,
STOPCOCKS, FERRULES, &c.
CAST-IRON WORK, and
SLUICE VALVES.

Particulars and Forms of Tender can be obtained at this Office on and after Friday, the 29th of January, 1904.

The lowest or any Tender will not necessarily be accepted.

Tenders, enclosed in envelopes provided, to be delivered at this Office by Twelve o'clock noon, on Tuesday, the 16th of February, 1904.

FRANK HOWARTH, Assoc.M.Inst.C.E.,
Water Engineer.

Municipal Offices, Plymouth,
Jan. 22, 1904.

THE GASLIGHT AND COKE COMPANY.

TENDERS FOR DISUSED GAS PLANT.

THE Directors of the Gaslight and Coke Company are prepared to receive sealed TENDERS for the purchase of a quantity of DISUSED GAS PLANT on the site of the Company's premises at Laburnam Street, Kingsland Road, London, N.E., comprising EXHAUSTERS, ENGINES, &c., BEAM ENGINES, PUMPS, &c.; BOILERS; TAR AND LIQUOR LOADING TANKS; COAL-TRUCKS; COKE-BARROWS; RAILS; ASCENSION-PIPES; MOUTHPIECES; CONDENSERS; TAR-EXTRACTOR; SCRUBBERS; PURIFIERS; STAGE PLATES, &c.; and RETORT-HOUSE MAINS, in accordance with the Terms and Conditions of a Specification and Form of Tender to be obtained at the Chief Office of the Company, as below.

Tenders for the whole or for any portion of the Plant specified to be sent in on or before Thursday, the 11th prox., addressed to the undersigned, and endorsed "Tender for Disused Gas Plant."

The Directors do not bind themselves to accept the highest or any Tender, and reserve to themselves the right of accepting the whole or a portion only of any one Tender.

By order,
HENRY RAYNER,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W., Jan. 22, 1904.

BOROUGH OF CHELMSFORD.

PUMPING MACHINERY.

TENDERS are invited for the construc- tion and erection of a Compound Vertical Inverted ENGINE and BOREHOLE PUMP, with the necessary Gearing, &c.

The Plans and Specification may be inspected at the Office of the Borough Surveyor, 16, London Road, Chelmsford, or copies can be obtained from the Engineer, Mr. Percy Griffith, M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, S.W., on payment of £5, which will be returned on receipt of a *bonâ-fide* tender.

Sealed Tenders, on the Form provided for the purpose, must be delivered at my Office, before Twelve o'clock noon on Saturday, the 20th day of February, 1904.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
THOMAS DIXON,
Town Clerk.

BOROUGH OF NELSON.

SUPPLY OF GENERAL REQUIREMENTS AND SALE OF SURPLUS TAR.

THE Gas Committee invite Tenders for the supply of the following requirements during the Twelve Months ending March 31, 1905.

(*a*)—SULPHURIC ACID.
(*b*)—LIME.
(*c*)—IRONMONGERY.
(*d*)—BRASS FITTINGS.
(*e*)—CAST-IRON PIPES and SPECIALS.

The Committee also invite TENDERS for the purchase of the surplus TAR produced at their Nelson and Brierfield Works during the Twelve Months ending March 31, 1905.

Form of Tender for each item, together with full Particulars, may be obtained on application to Mr. A. J. Hope, Engineer, Gas-Works, Nelson.

Sealed Tenders, duly endorsed, must be sent to the undersigned not later than Tuesday, the 16th day of February, 1904.

J. H. BALDWICK,
Town Clerk.

Town Hall, Nelson,
Lancs., Jan. 25, 1904.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 12th day of February, 1904, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 31st of December last, to declare a Dividend for the same period, to elect Two Directors and One Auditor in the place of those retiring by rotation, and for General Purposes.

NOTICE IS HEREBY GIVEN, that an Extraordinary Meeting of the Proprietors of the Crystal Palace District Gas Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 12th day of February next, at 3.30 o'clock in the afternoon, or as soon thereafter as the business of the Ordinary Meeting of the Proprietors shall be concluded, for the purpose of considering the Provisions of the Bill now before Parliament, intituled "A Bill to alter the Provisions of the Acts of the Crystal Palace District Gas Company with respect to the illuminating power of gas supplied by them and the testing of gas and to change the name of the Company to 'The South Suburban Gas Company,' and for other purposes."

At such Meeting the said Bill will be submitted for the consideration and approval of the Proprietors.

Dated this 29th day of January, 1904.

The TRANSFER BOOKS WILL BE CLOSED from the 29th day of January, until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
Jan. 29, 1904.

WREXHAM AND EAST DENBIGHSHIRE WATER COMPANY.

SALE BY TENDER OF £8000 OF ORDINARY STOCK entitled to a Maximum Dividend of 7 per cent. per annum.

LAST DIVIDEND £5 5s. PER CENT.

MINIMUM PRICE OF ISSUE, £125 PER £100.

NOTICE is Hereby Given, that, in ac- cordance with the Provisions of the Wrexham Water Order, 1898, the Directors of the Wrexham and East Denbighshire Water Company intend to SELL BY TENDER EIGHT THOUSAND POUNDS OF ORDINARY STOCK.

The Stock forms part of the Additional Capital created under the Powers of the above-mentioned Order, and will rank for Dividend up to 7 per cent. per annum; being entitled to 7-10ths of that payable on the Consolidated Stock, which at present receives 7½ per cent. per annum.

The Stock will be issued in Lots of £100; and the minimum price, below which no Tender will be considered, is £125. The purchase money to be paid to the Company's Bankers as follows: One-half on the 1st of March, 1904, and the balance on the 1st of June, 1904, or the whole amount may be paid up on the 1st of March.

Copies of the Order may be seen, and further Particulars obtained, at the Company's Offices, 21, Egerton Street, Wrexham.

Tenders, endorsed "Tender for Ordinary Stock," to be sent to the undersigned on or before Monday, the 8th of February.

No special Form of Tender required.

By order of the Directors,
FREDERICK STORR,
Engineer and Secretary.

Water-Works Offices, Wrexham,
Jan. 13, 1904.

N.B.—At £125 per cent. this Stock will bring in an immediate return to the purchaser of £4 4s. per cent., free of Income-Tax.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Friday, the 5th day of February next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 31st day of December last, and to elect Directors and Auditors in the place of those who will at such Meeting go out of Office in compliance with the Company's Acts or Schemes of Amalgamation.

By order,
HENRY RAYNER,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W., Jan. 18, 1904.

BOURNEMOUTH GAS AND WATER COMPANY.

ISSUE OF £10 SEVEN PER CENT. "B" SHARES,

MINIMUM PRICE OF ISSUE, £15 PER SHARE.

SALE BY TENDER OF 1000 £10 SEVEN PER CENT. "B" SHARES, in pursuance of the Provisions of the Bournemouth Gas and Water Act, 1896.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER 1000 "B" SHARES OF £10 EACH (the Dividend on which is limited to £7 per cent.), to be paid up in full on or before the 30th of April, 1904.

The Dividend on the Ordinary Shares for the Half Year ended the 30th of June, 1903, was at the rate of 10 per cent. per annum, with an addition at the rate of 3 per cent. per annum under the sliding-scale, and on the "B" Shares at the rate of 7 per cent. per annum. These dividends have been maintained at the above rates since Dec. 31, 1888.

The net profit earned in the Year ended June 30, 1903, after deducting all charges, including debenture interest, amounted to £29,418 2s 1d., which sum was available for payment of dividends.

During the same Twelve Months, the sum of £2000 was added to reserve fund from profits, and also £703 18s. 2d. from interest on reserve investments, and, after payment of dividends to June 30, 1903, the sum of £6743 6s. 3d. remained to be carried forward to the Half Year ending the 31st of December, 1903.

Particulars and Conditions of Tender may be obtained at the Company's Offices, Bournemouth, or of the Secretary as under.

Sealed Tenders must be sent to the Secretary not later than Eleven o'clock on Thursday morning, the 11th of February, 1904.

By order,
WILLIAM CASH,
Secretary.

London, 90, Cannon Street, E.C.
Jan. 14, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK,

AND

£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 2, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

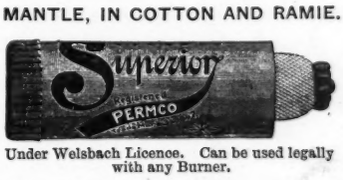
THE PERFECT MANTLE CO.

1c, Aldgate Avenue, London, E.C.

MANUFACTURERS OF THE WELL-KNOWN

SUPERIOR "PERMCO"

MANTLE, IN COTTON AND RAMIE.



Under Welsbach Licence. Can be used legally with any Burner.

Trade Price 26s. 6d. per Gross.

Reduction for Quantities.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

THE FLOW OF GASES AND PROPORTIONING GAS-MAINS.—By F. SOUTHWELL CRIPPS, Assoc. M.Inst.C.E. *Price 7s. 6d.*

REPORTS OF DISTRICT ASSOCIATIONS OF GAS ENGINEERS AND MANAGERS FOR 1902. *Price 5s. 6d.*

GAS COMPANIES' BOOK-KEEPING.—By JOHN HENRY BREARLEY and BENJAMIN TAYLOR, of Longwood. *Morocco Gilt*, 18s.

AUTOMATIC METER REGISTER.—By ROBERT P. KEYS. *In sizes to record 1000 Meters, with Index, half bound, 42s.; to record 500 Meters, 35s.; to record 250 Meters, 31s. 6d.*

SANDELL'S GAS COMPANIES' EXPENDITURE JOURNAL.—*Price, two quires, 36s.; three quires, 45s.*

SANDELL'S GAS COMPANIES' RENTAL-BOOK.—*Price, two quires, 36s.; three quires, 45s.*

SANDELL'S ANALYZED WAGES BOOK.—*Price, two quires, 15s.*

TABLES OF VALUES, DISCOUNTS, DIVIDENDS, AND WEIGHTS AND MEASURES FOR USE IN GAS OFFICES. By THOMAS NEWBIGGING, M.Inst.C.E. *Price 2s.*

DOWDING'S WAGES TABLES, Calculated for Wages payable by the hour.—By EDWIN DOWDING. *Price 3s. 6d*

GAS-WORKS DIRECTORY, 1902-1903. *Price 6s.*

CHURCH LIGHTING.—By J. H. TROUGHTON, *Price 9d. per dozen*; 100, 4s. 6d.

THE CHOICE OF GAS-FIRES.—By THOS. FLETCHER, F.C.S. *Price 3s. per* 100. Special Quotations for large Quantities.

GAS AND HOW TO USE IT.—By J. H. TROUGHTON. *Sample copies 6d. each.* 100, £2; 250, £4 10s.; 500, £7 10s.; 1000, £10.

ANALYSIS OF THE ACCOUNTS OF THE METROPOLITAN WATER COMPANIES (Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex), and of the CORPORATION WATER UNDERTAKINGS OF EDINBURGH, GLASGOW, and MANCHESTER, for the Year 1902-1903. By WOOD, DREW, & Co., Chartered Accountants. *Price 15s.*

THE COMPOSITION AND USE OF GAS LIME IN AGRICULTURE.—By (the late) Dr. VOELCKER, Professor of Chemistry to the Royal Agricultural Society of England. *Price 5s. per* 100.

ALEXANDER CAMERON,

GAS AND CANNEL COAL MERCHANT,

48, WEST REGENT STREET,

GLASGOW.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

A Revolution in Gas-Fittings

IS THE

'Volonta'

RISING & FALLING

Pendant

WITH FLEXIBLE STEEL TUBES.

It Challenges the Electric Light for *Utility, Novelty, & Adjustability, and a Charming Appearance of Slender Elegance.*

Patented in many Countries.

Sole Patentees and Manufacturers:

EDWARD J. SHAW & CO., WALSALL.

THE

PETROLEUM GAS SYNDICATE

Supply and erect Complete Installations of their

PETROGENE PATENT GAS PLANT

On SALE, HIRE, or ROYALTY.

PETROGENE GAS is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.

The Syndicate is prepared to entertain offers of sale of small Gas-Works, whether profit earning or not.

Offices: 28, Victoria St., Westminster.

Works: 10, Rochester Row, S.W.

THOMAS DUXBURY & CO.,

16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & SON,

165, QUEEN VICTORIA STREET, E.C.;

And at STROUD, GLOUCESTERSHIRE.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

THE

"ROTARY"

STATION METER.

Efficiency Demonstrated.

APPLY—

T. G. MARSH,

MAWSON CHAMBERS, DEANSGATE,

MANCHESTER.

THOMAS BUGDEN, MANUFACTURER OF

TAR and LIQUOR HOSE, and Special AIR TUBING.

BELLOWS made to inflate a 48-inch Bag under One Minute. Various sizes made.

STOKERS' MITTS. Made from best Tanned Leather.

India-rubber Goods of every description, Leather Bands Oils, &c., Diving and Wading Dresses, Waterproof Coats and Capes, Sewer Boots, and Theatrical Air-Proof Dresses.

Fire-Engine Hose and Appliances.

Best Materials and Workmanship Guaranteed.

Gas-Bags for Mains. All Seams Stitched and Taped.

Miners' Woollen Jackets No. 1, 12/- each; No. 2, 9/6.

116-118, GOSWELL ROAD, E.C.

HARPER & MOORES, Limited,

STOURBRIDGE.

MANUFACTURERS OF

GAS-RETORTS,

Inclined, Horizontal, and Segmental.

Fire-Bricks, Fire-Clay Lumps, and Tiles

OF EVERY DESCRIPTION.

Also Manufacturers of Cast-Iron Retorts, Iron Mouthpieces Pipes, and all necessaries for Gas-Works requirements.

Telegraphic Address: "MOORES, LYE." Telephone No. 23 Lye.

GOLD MEDAL, CRYSTAL PALACE, 1904.

THE WELSBACH MANTLE WITH PLAISSETTY IMPROVEMENTS.

Sole Makers for the United Kingdom: THE WELSBACH INCANDESCENT GAS-LIGHT CO., LTD.

The Report of Mr. Horatio Ballantyne, F.I.C., F.C.S., on the Plaissetty Mantle on a COTTON Foundation.

To The Plaissetty Mantle Syndicate, Limited,
6, Old Serjeants' Inn, Chancery Lane, E.C.

In accordance with your instructions, I have made an investigation into the Welsbach Mantle with Plaissetty improvements, and beg to report as follows:—

PROCESS OF MANUFACTURE.

I have visited your factories at Great Saffron Hill and Lewisham on two occasions, and have examined closely each step in the manufacture. The processes are simple and perfectly practicable. An examination of the mercerized tissue at the various stages showed it to be regular in thickness, and to afford an oxide skeleton of uniform thickness and character.

A large number of the impregnated fabrics were burned off in my presence. The results were very satisfactory; only 1 per cent. of the mantles were defective, the flaws being similar to those which commonly occur in burning off ordinary cotton fabrics. In shapeliness, and in uniformity of length, diameter, and weight, the mantles left nothing to be desired. In these respects, and in ease of burning off, the manufacture resembled that of the ordinary Welsbach mantle. Each mantle weighed 0·75 gramme, including the asbestos, equal to 0·68 gramme of oxides per mantle.

It may be mentioned that the impregnated fabrics were used in the flattened state, as they came from the steaming drum; yet no folds or ribs were left in the burned mantles. This is of importance with reference to what would be required of fabrics packed and sent abroad.

From the commercial point of view the manufacture is perfectly satisfactory.

I chose for the purpose of comparison the ordinary Welsbach mantle as being, in my judgment, the best mantle on the market.

The mantle is much stronger than the ordinary Welsbach mantle, as will be seen below; hence the operations of toughening, trimming, &c., after burning off, call for no remark.

DURABILITY OF LIGHTING POWER.

In the table below are summarized the results of tests in which the mantles were kept burning continuously for 550 hours, photometric tests being made at the periods stated. Each figure gives the average horizontal illuminating power, and for comparison there are given the results of a similar test which I made during the previous month with ordinary Welsbach mantles.

The results, it will be seen, are extremely good. The illuminating power fell only 1-candle power during 450 hours' burning—viz., from 17·5 to 16·5 candle-power per cubic foot of gas. In the same time the ordinary Welsbach mantle fell from 20 candles to 11·7 candles with the most favourable rate of consumption. After 550 hours the Syndicate's mantle had lost 12·5 per cent. of its original lighting power, whereas the Welsbach mantle, to judge from the luminosity curve, had lost 46 per cent. in the same time.

If the limit of useful life of a mantle be taken as the time when it ceases to give more than 10 candles per cubic foot, it will be seen that the ordinary Welsbach mantle had reached that limit in about 650 hours; whereas it would appear from the curve of results accompanying this report that the limit would not be attained by the Syndicate's mantle till after 1000 hours' burning.

DURABILITY OF LIGHTING POWER.

	Candle Power.	Cubic Feet Gas Consumed.	Candles per Cub. Foot.
(1) Syndicate's Mercerized-tissue Mantle, Burned Off Over Low-pressure Flame:—			
At start	70·3	4·0	17·5
After 112 hours	69·2	4·0	17·3
After 280 hours (1)	66·5	4·0	16·6
After 280 hours (2)	64·5	3·75	17·2
After 450 hours (1)	64·3	3·9	16·5
After 450 hours (2)	61·1	3·7	16·5
After 550 hours	61·1	4·0	15·3
(3) Ordinary Welsbach "C":—			
At start	80·0	4·0	20·0
After 100 hours	63·2	4·0	15·8
After 250 hours (1)	51·3	4·05	12·6
After 250 hours (2)	50·1	3·8	13·2
After 450 hours (1)	43·8	4·05	10·8
After 450 hours (2)	43·9	3·75	11·7
After 690 hours (1)	31·1	4·0	7·8
After 690 hours (2)	33·4	3·37	9·9

The Welsbach ordinary mantles became much shrunken during the test, and it was necessary to reduce the rate of consumption of gas considerably to obtain the maximum efficiency for the quantity burned.

On the other hand, with the Syndicate's mantle, the maximum illuminating power was realized with practically the same gas consumption as at the start. The absence of shrinkage and the maintenance of illuminating power are remarkable, and I know of no other mantle of good lighting power which even approaches those of the Syndicate in these respects.

PHYSICAL STRENGTH.

(1) Resistance to Lateral Shocks and Vibrations:—

For testing the effects of lateral vibrations and shocks, the apparatus used consisted of two burners fixed side by side on a small swinging platform, which was driven to and fro against a fixed stop by the action of a crank wheel, driven by a small water turbine. The supports of the mantles were fixed rigidly. The throw of the platform was 1·3 inches, and it knocked against the stop 200 times per minute.

Nine mantles were tested on the vibrator, including four which had been burned off over the high-pressure flame. The time, and the number of beats, respectively, required to cause the mantles to begin to break, were as follows:—

Maximum.	Minimum.	Average.
44½ minutes.	2 minutes.	10 minutes.
8900 beats.	400 beats.	2000 beats.

Tested under identical conditions, the ordinary Welsbach mantles mostly broke after a few beats, and the best of them stood 30 seconds (100 beats), these being smashed up entirely. None of the Syndicate's mercerized tissue mantles gave way at the head or any part except round the rim of the burner, and it was obvious that simple friction, owing to the somewhat violent and rapid striking of the skirt of the mantle against the burner, was mainly responsible for the breakage.

The very great superiority of the Syndicate's mantles under the conditions of the test is obvious.

It ought, perhaps, to be mentioned that both in these and the following tests the two sorts of mantles had been toughened, and the toughening film had then been burned off, prior to the tests, the conditions in this respect being kept the same.

(2) Resistance to Vertical Vibrations.

In testing the effects of vertical vibrations on the mantles, the platform carrying the two burners was fixed to the end of a small springboard, which was caused to vibrate by means of a small weight (actuated by a turbine-driven crank wheel) which fell lightly upon it at 200 beats per minute.

Thirteen of the Syndicate's mantles were tested on this vibrator, including five which had been burned off on the high-pressure flame. One mantle remained whole at the end of 8 hours, when the test was stopped; one remained whole after 5¼ hours, when the test was stopped; and one remained whole at the end of 1¼ hours. The remaining ten broke as follows:—

Maximum.	Minimum.	Average.
168 minutes.	2 minutes.	45 minutes.
33600 beats.	400 beats.	9000 beats.

Of course, no reliable average figure for all the mantles can be given, as it is not known when the first three mantles would have given way.

Tested in the same way, the majority of the ordinary Welsbach mantles dropped from the head after a few beats. The best mantle stood 30 seconds (100 beats).

I know of no fairer criteria of the strength of a mantle, under ordinary conditions of use, than these vibrator tests, and they leave no doubt that the mantles which I have examined excel in strength any other thoriaceria mantles that I have met with. This conclusion is corroborated by a number of the usual rough and ready tests.

It is quite likely that the strength of the mantles, to which this report relates, may have been contributed to by the method of knitting-in the heads, and by the use of a suitable "fixine." Apart, however, from the strength of the head, which is a matter of great importance, the structure possesses a toughness throughout. The mantles exhibit no tendency to get cut round the burner rim by the action of the flame. They possess the characteristic that cuts or fractures do not tend to spread rapidly—which is a notable and valuable point of distinction from the ordinary mantle.

Yours faithfully,

HORATIO BALLANTYNE.

17*th October*, 1903. 75, Chancery Lane.

CAUTION.—Order the Mantle made on COTTON Foundation which is far the best.

THIS ADVERTISEMENT IS INSERTED BY

THE PLAISSETTY MANTLE SYNDICATE, 6, OLD SERJEANTS' INN, E.C.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

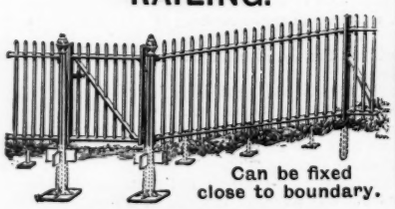
LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

BAYLISS,
JONES,
AND
BAYLISS
LIMITED,
Manufacturers of
IRON FENCING, &c.

PATENT SELF-ADJUSTING
RAILING.



Can be fixed close to boundary.

COKE BARROWS.

LIST FREE.

ILLUSTRATED CATALOGUE OF RAILINGS OF TUBULAR FENCING, GATES &c., FREE
VICTORIA WORKS, WOLVERHAMPTON.
LONDON OFFICES AND SHOW ROOMS—139 & 141, CANNON STREET, E.C.

FIRE

That will satisfy your most fastidious Customer.

BRILLIANT. WARM. NOISELESS.

Send small Sample Order.
Your further Orders will follow.

THE IMPERIAL STOVE CO.,
LEAMINGTON SPA.
Telegrams: "Imperial, Leamington."
Telephone: One X.

GOLD MEDAL FOR FIRES AWARDED 1903.

GOLD MEDAL FOR COOKERS AWARDED 1903.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
Also Removal of last Traces of
SULPHURETTED HYDROGEN
in catch position.

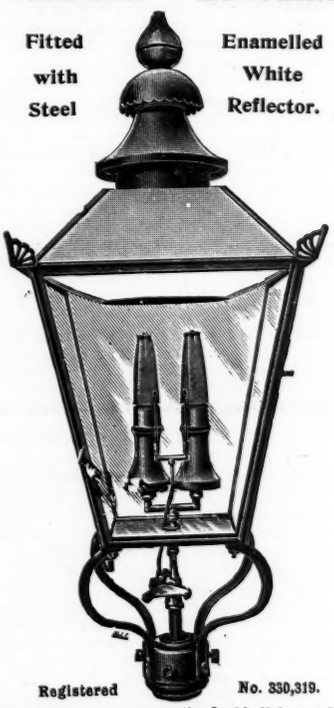
Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

THE
"KILBURN" LANTERN.

Fitted with Steel

Enamelled White Reflector.



Registered No. 330,319.

The "Kilburn" Lantern (for double lights) and the "St. Albans" Lantern have been adopted for lighting the Town of St. Helens.

H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

MOBBERLEY & PERRY,
STOURBRIDGE.

INCLINED RETORTS A SPECIALITY.

HORIZONTAL AND SEGMENTAL RETORTS.
BEST QUALITY OF FIRE-CLAY GOODS.
Specials for Water-Gas Plants. Chequer Bricks always in Stock.

THE LIGHT OF THE FUTURE

IS THE

"STAR"

Inverted Incandescent Burner

PATENT No. 5977.

A Brilliant Illuminant of **70-Candle Power.**

Gas Consumption, **2½ cubic feet per hour.**

Artistic in Appearance.

Supersedes Electricity at one-tenth of cost.

A DOWNWARD LIGHT OF GREAT INTENSITY.

A PERFECT SHADOWLESS FLAME.

BURNER, MANTLE, AND GLOBE, 6s., Subject.

THE

'STAR' Inverted Incandescent Burner

COMPANY, LIMITED,

59a, Farringdon St, LONDON, E.C.

Telephone: No. 5179 HOLBORN.

Telegrams: "INVERTAMUS, LONDON."

HAVE YOU GOT THE

"WIS" LAMP

IF NOT, WHY NOT?

Most Powerful and Practical on the Market.

POND & CO. 62, FARRINGDON ST., E.C.

Gas Engineers, Patentees and Manufacturers.

BEWARE INFRINGEMENTS.

THE *LUCAS*

GAS-LAMPS.

FOR

Indoor & Outdoor Lighting.

ECONOMY.

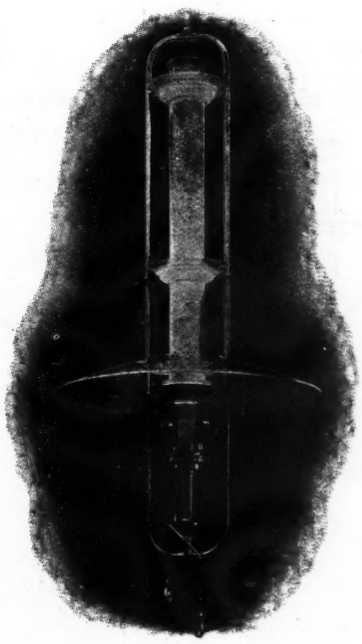
Over 40-Candle Power per Cubic Foot.

EFFICIENCY.

200, 400, 700, or 1000 Candle Power.

SIMPLICITY.

No Compressing Plant or High Pressure.



ON VIEW AT THE SHOW-ROOMS OF

JAMES MILNE & SON, LIMITED,

AT

133, George Street, EDINBURGH,

111, St. Vincent Street, GLASGOW,

59, Farringdon Road, LONDON,

34, Wellington Street, LEEDS,

OR AT

Milton House Works, EDINBURGH.

COAL TAR PRODUCTS

Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Crude Creosote Salts, Granulated (Crude) Naphthalene, Sublimed Naphthalene, Anthracene, Refined Tar, Pitch, also Sulphate of Ammonia.

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY,**
709, OLD KENT ROAD, LONDON, S.E.
Works: ORDNANCE WHARF, EAST GREEWICH, LONDON, S.E. Telegraphic Address: "METROGAS, LONDON."

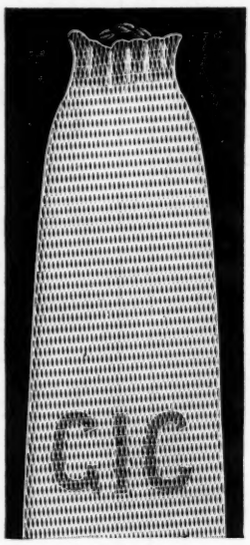
G.I.C. RAMIE

G.I.C. Pure Ramie Mantles are rapidly becoming the recognized Maintenance Mantles with most Gas Companies and Lighting Authorities.

No better Mantle can be produced; therefore **why pay more**?

Made in 6 different sizes, from the Gem to the Lucas.

The difficult problem of Profitable Maintenance may be at once effectually solved by using this Mantle.



G.I.C. RAMIE

PRICES.	BURNERS.	Per Gross Subject.
G.I.C. Pure Ramie Mantle for "C."	.	27s.
G.I.C. ,, ,, ,,	No. "2" Kern	27s.
G.I.C. ,, ,, ,,	No. "3" ,,	27s.
G.I.C. ,, ,, ,,	No. "4" ,,	30s.
G.I.C. ,, ,, Long ,,	High Pressure	45s.
G.I.C. ,, ,, ,,	Lucas Lamp	7s. per doz

A trial gross for testing will be sent at these Prices on receipt of order, carriage paid.

SOLE MANUFACTURERS:
The GENERAL INCANDESCENT COMPANY, Ltd.,
Telegrams: "ASABLAZO, LONDON." 56, CITY ROAD, LONDON, E.C. Telephone No. 9536 London Wall.

R. LAIDLAW & SON,
LIMITED
GAS & WATER ENGINEERS,

SIMON SQUARE WORKS, EDINBURGH.

6 LITTLE BUSH LANE, LONDON, E.C.

TWO STATION METERS EACH TO PASS 200000 CUB. FT PER HOUR. ERECTED AT THE

GRANTON GAS WORKS FOR THE EDINBURGH & LEITH GAS COMMISSIONERS.

ALLIANCE FOUNDRY & ENGINEERING WORKS, GLASGOW.

TELEGRAMS, "UNBEATEN," BIRMINGHAM.

TELEPHONE No. 815.

GAS, WATER & STEAM TUBES AND FITTINGS

The STAFFORDSHIRE TUBE Co. LTD.

HEAD OFFICE Edmund Street, BIRMINGHAM

Telephone No. 756 Bank. *Telegrams: "Robustness, London."*

Please Note **CHANGE OF OFFICES** from Rooms 388 to 390 Second Floor, to **ROOMS 279, 279a, 280, 281, & 282 FIRST FLOOR**

MANSION HOUSE CHAMBERS, LONDON, E.C.

INCLINES, HORIZONTAL, FLOOR LEVELS, GENERATORS,

AND REGENERATORS.

HIGH-CLASS

RETORT WORK

GUARANTEED.

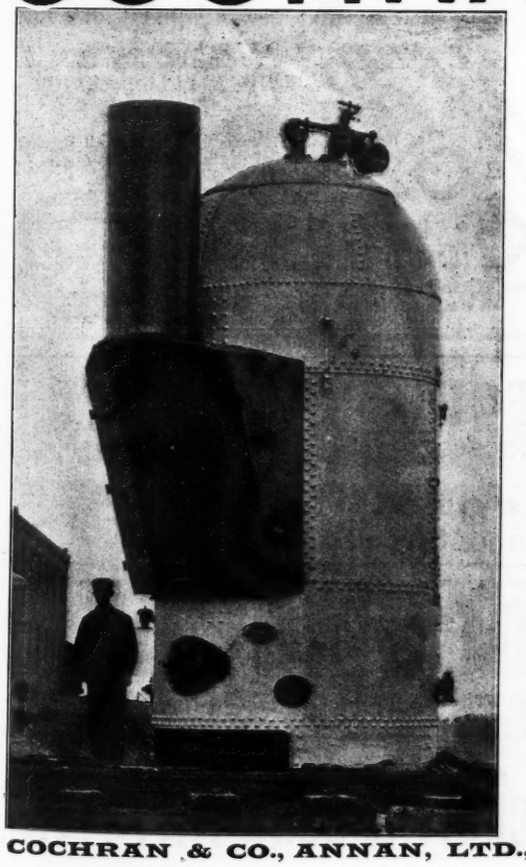
GENERAL GAS AND WATER WORKS CONSTRUCTORS.

MAINLAYING.

Plans & Particulars—**J. & H. ROBUS, Engineering Contractors,** **LONDON & GORING.**

COCHRAN

PATENT VERTICAL MULTITUBULAR



BOILERS.

RAPID AND ECONOMICAL STEAM GENERATORS.

EASILY CLEANED.

EASILY ERECTED.

NO BRICKWORK SETTING REQUIRED.

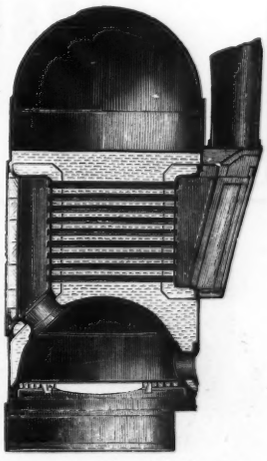
SINGLE BOILERS

FROM

10 TO 150

I. H. P.

BATTERIES UP TO ANY POWER.



London Office: **SANCTUARY HOUSE, TOTHILL STREET, WESTMINSTER.**
Telegrams: "MULTITUBE, LONDON."
Telephone: 650 VICTORIA.

COCHRAN & CO., ANNAN, LTD., ANNAN, SCOTLAND. Telegrams: "MULTITUBE, ANNAN."

CASES FOR BINDING
QUARTERLY
VOLUMES OF THE "JOURNAL"
PRICE 2s. EACH.

THE ROYAL "ERA" INCANDESCENT MANTLE SYNDICATE,
Telegrams: "BERYLLINE, LONDON."
Telephone: "672 BATTERSEA."
Rodwell Works, Bassingham Road, WANDSWORTH, LONDON, S.W.
MANUFACTURERS OF THE WELL-KNOWN
'ERA' & 'BRITISH' MANTLES
In Cotton, Ramie, and Double-Woven for "C" and Kern Burners, and in all Sizes; also for Lucas Lamp.
These Mantles are Reliable, Durable, and Brilliant.
SEND FOR PRICE LIST.
Special Prices to Gas Companies and Lighting Authorities.

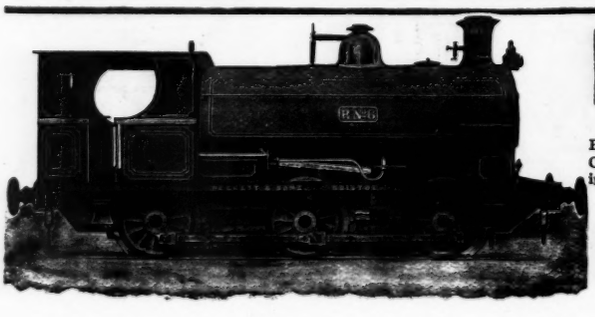
JOSEPH CLIFF & SONS
(BRANCH OF THE LEEDS FIRE-CLAY CO., LTD.),
WORTLEY, LEEDS.
Cliff's Wortley Silica Bricks.
FOR Arches and Crowns where high heats are required. They contain over 90 per cent. of Silica, and are nearly stationary under the influence of heat, swelling a little rather than contracting. They are not like a Gannister or Dinas Brick, but a Fire-Brick of a highly Silicious nature.
Cliff's Wortley Aluminous Bricks.
THESE are for Side Walls where great wear and tear takes place. Are made of a specially prepared mixture, are high in Alumina, and are what is termed a HARD FIRE-BRICK.
BALTIC WHARF, WATERLOO BRIDGE, LONDON, S.E.
Liverpool: Leeds Street. Leeds: Queen Street.

WILSON CARTER & PEARSON LIMITED,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas and Other Purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

THE EXPORT MANTLE
SUPPLIED TO 180 GAS COMPANIES.
Illuminating Power 80 to 700 Candles.
EXPORT MANTLES, 24/- PER GROSS.
EXPORT REMA SILK MANTLES.
EXPORT HIGH-PRESSURE MANTLES.
Special Quotation for Large Quantities
MANTLES MADE to COMPANY'S own PRESCRIPTION.
Special low Quotations with their own Labels and Stamps.
Burners of all descriptions, solid Brass, from 1/9 per dozen.
NEW EXPORT INCANDESCENT LIGHTING CO., LTD.,
36 MANSELL STREET, LONDON, E.C.
Telephone No. 4946 Central.
Telegraphic Address: "Export Mansell Street, London."

LARGEST MANUFACTURERS in the UNITED KINGDOM of GAS-RETORTS,
Horizontal or Inclined; also Makers of Segmental Retorts of all Sections.
PATENTEES OF
Machine-Flanged RETORTS.
B. GIBBONS, JR., LD.
TELEPHONE DUDLEY NO. 10.
DIBDALE WORKS, DUDLEY.
Telegraphic Address: MACHINE, LOWER GORNAL.
SPECIAL BRICKS & BLOCKS of every description for GENERATOR and REGENERATOR FURNACES.
Large Stocks of Bricks of all sizes, Burrs, Boiler Seating Blocks and Covers, Plain and Rebated Tiles, &c., &c.
"ABC" Code and UNICODE used for Telegrams and Cablegrams.
Retorts and other Fire-Clay Goods carefully packed for export.
FOREIGN AND HOME COPIES OF ILLUSTRATED CATALOGUES ON APPLICATION.

ABSORPTION OF FOUL GASES.
(HEMINGWAY'S PROCESS.)
FOR PARTICULARS APPLY TO:
ROBERT BOOTH,
110, Cannon Street, London, E.C.


LOCOMOTIVES
LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate Delivery.
Photographs, Specifications, and Prices on Application.
PECKETT & SONS, Atlas Locomotive Works, BRISTOL.
Telegraphic Address: "PECKETT, BRISTOL."

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

CLAYTON SON & Co LTD LEEDS
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD ALSO
THE ORIGINAL MAKERS OF
SPIRAL GUIDED GASHOLDERS
MAKERS OF ALL KINDS OF
STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS
ROOFS RETORT FITTINGS
PURIFIERS RETORT LIDS
ANTIFREEZERS for Gasholders
STEEL TANKS
OF ALL SIZES
MAKERS OF THE LARGEST IN THE WORLD.
GASHOLDERS
OF EVERY DESCRIPTION & SIZE.
HIGH CLASS BOILERS FITTED WITH DEIGHTON'S PATENT CORRUGATED FLUES.
Telegrams "GAS LEEDS." London Office 60 Queen Victoria St E.C.

MANNESMANN

LAMP POSTS
made throughout of
WELDLESS STEEL TUBING
including base, ring, and ladder rest.

Light, Strong, Unbreakable, and Cheap.

GAS, WATER, & STEAM TUBES AND FITTINGS.

WELDLESS STEEL SPIGOT & FAUCET PIPES
for Gas and Water Mains.

Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.

THE BRITISH MANNESMANN TUBE COMPANY, LTD.,
Landore, South Wales.
Birmingham Depôt: 110, COLMORE ROW.
London Office: 110, CANNON STREET, E.C.

1904 RESOLUTION
Adopt a
"DELLWIK" WATER GAS PLANT
and ensure
ECONOMY, RELIABILITY & SIMPLICITY,
with
INCREASED DIVIDENDS.

MAKERS
R. & J. DEMPSTER,
GAS PLANT WORKS,
MANCHESTER. LIMITED,
LONDON OFFICE:
165, GRESHAM HOUSE,
OLD BROAD STREET,
E.C.

Wrought-Iron

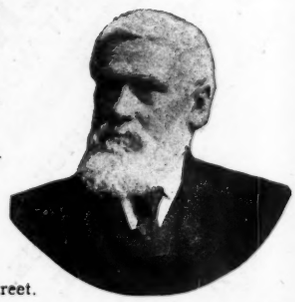
And Fittings & Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS GAS VALVES STEAM & WATER VALVES TOOLS. &c. AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.
LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "PARKER LONDON."

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·20.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."

CLAPHAM BROTHERS
ESTABLISHED 1837. KEIGHLEY. LIMITED.
WELLINGTON, NELSON, & MARKET STREET WORKS.
WASHER-SCRUBBERS
THE FAVOURITE CONDENSER
DRY-LUTE PURIFIERS

USE TIME WISELY
BY ADOPTING
Clapham's Patent Automatic Rapid Fastenings, and "ECLIPSE" Rubber Joint,
WHICH SAVE MONEY.

LONDON AGENT:
THOMAS B. YOUNGER, C.E., Chesterfield House, 98, Great Tower Street.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Jan. 26, 1904.